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EDITORIAL NOTES.

The New Livesey Professor.

INTIMATION reaches us from the Vice-Chancellor of the University of Leeds, that Mr. John William Cobb, B.Sc., has been appointed Professor of Coal Gas and Fuel Industries, in succession to Dr. W. A. Bone, F.R.S., who, as readers are aware, has accepted the Professorship of Fuel and Refractory Materials at the Imperial College of Science and Technology. The question as to who would be the successor of Dr. Bone in the Livesey Chair has been one that has naturally been a matter of some concern to the gas industry, as, it is fully recognized, that to the occupant of that chair the industry must look for the exertion of the influence that will make the Livesey Memorial one of the valuable assets of the industry. We may bespeak for Mr. Cobb a hearty welcome to the gas industry; and, of this we are confident, that the more the members of the industry get to know of Mr. Copp, his fitness for the post of honour and influence to which he has been appointed, and the character of his attainments, the more gratifying will his election be to the industry. Of this he may be assured, that the heartiest wishes for his success in his new office will accompany him from the gas industry, inasmuch as his success must reflect itself upon its interests.

It has, we may be certain, been a matter of considerable difficulty to place hands for this particular professorship on the scientist with practical experience and all the essential qualifications. Professor Cobb has had a training during the past twenty years, or thereabouts, in positions that have called for the blending of theory with practice. He comes to his new labours direct from the works of the world-renowned Farnley Iron Company, where, since the end of his scholastic career, he has spent practically the whole of his working days. His training there will be very valuable to an industry whose fuel and other products are becoming daily of greater economic importance to both the general community and to manufacture. First, he was chemist to the Company, and ultimately technical assistant to the Managing-Director. In a works of this kind, the fuel-using processes take a place in the operations second to none; and the control and development of these processes have been largely under his care—more especially since the introduction of the Mond gas process, with ammonia-recovery. This gas has been used for furnace heating, for burning glazed ware, also for power purposes. From this it is seen that in Professor Cobb we have a fuel-gas man, fresh from the practical applications of such gas under scientific superintendence. It will therefore be easy for him to adapt himself to the special requirements and lines of development of the gas industry.

From all points of view, we have complete confidence in the wisdom of the choice of the Livesey Memorial Committee, and of the ratification of this choice by the Leeds University authorities. The highest hopes may be entertained of the development by Professor Cobb of the Coal Gas and Fuel Department on lines which will lead to success, and give confidence to the members of the gas industry that their interests are fully respected. Professor Arthur Smithells, we know, has the very highest opinion of Mr. Cobb, and regards him as an ideal University representative of a technological subject.

Chemical Manufacturers and the Gas Industry.

A NEW and inexplicable phase has arisen in connection with the hostility of the Alkali Manufacturers' Association to the gas industry, and the restriction they have set themselves to build about the residual products business of the latter. It is simply and plainly this, that the parliamentary authorities who deal with Private Bill legislation are assisting these non-statutory chemical manufacturers to put limitations on the part of the business of statutory gas concerns that is subject to open competition, and without giving the companies or corporations an opportunity of saying whether or not they desire to contest the matter. Is this just? There is only one answer to the question, and that is an emphatic "No." The action of the authorities is one that an outsider cannot understand, look at it which way he may; and it is impossible for an outsider to see the reasoning that lies behind it, or to adjust the statements that are made in regard to it. Take the Belfast Corporation Bill as the first example. It is a lands and works measure; and, in the lands and works clause, there are the usual words: "May manufacture [on "the lands], produce, convert, store, and sell or dispose of, "residual substances, liquids, and products arising in the "manufacture of gas." The Bill duly comes before the Unopposed Bills Committee; and, on doing so, Mr. Ernest Moon, K.C., Speaker's Counsel, suggests that after "gas" the words "by them" should be inserted. This has been done; and thus upon Belfast is imposed, by this slight addition, the same restriction as was inflicted in the cases of the South Suburban, the Annfield Plain, and the Fleetwood Gas Companies—to the advantage of the uncontrolled competitors of the gas industry. Mr. Moon simply "presumed" that the Corporation desired to only deal in their own gas residual products. Why he should "presume" anything of the kind is not at all clear. The Corporation were not even permitted an opportunity of considering the matter, before the proposition was abruptly made for the insertion of the words which, for always (unless annulled later), will prevent them—whatever may be their future desire, whatever may be the future developments—from supplementing their own residuals production, or rendering profitable assistance to neighbouring small gas undertakings by giving them an opportunity of disposing of their residuals to the Belfast Gas-Works, if these works can offer them a better market than the chemical manufacturers are inclined to do. This is a position in which Parliament ought not to place statutory concerns in respect of the part of their business that is subject to free competition both in and beyond the locality in which they trade in their staple commodity. It is giving protection to non-statutory chemical manufacturers and to coke-oven owners at the expense of statutory gas undertakings. The situation is a monstrous one.

Take another example—the Leatherhead Gas Company's Bill. When this came before the Unopposed Bills Committee, it was stated that the Lord Chairman had asked for the insertion of the chemical clause. Why should the Lord Chairman ask for anything of the kind in the case of an unopposed measure? Mr. Moon remarked that the clause might as well go in, as he did not suppose that the Company would want to manufacture chemicals. We quite agree the Company are not likely, standing alone, to ever want to manufacture chemicals. What it might be to their interest, and to the interest of their gas consumers, to do in future in conjunction with other companies is quite another matter. If, too, this chemical clause is going to be imposed in this way in the case of all undertakings that come to Parliament, it will eventually be placed upon concerns that might be very useful to the Leatherhead Company and their consumers in relieving them, at a better price than they could get elsewhere, of their residual products. If the course the Parliamentary Private Bill authorities are pursuing is persisted in, it simply means that the time will arrive when, through the monopoly the authorities are aiding in setting up, they will have forced all gas undertakings who are not large enough to work up their own residuals to go to the nearest chemical manufacturer on his own terms. That is one of the sinister and ugly features of the present position. No gas undertaking ought to tamely accept the limiting clause simply for the purpose of getting a Bill through Parliament, without having a straight decision from a Select Committee. A curious point about the action of the Unopposed Bills Committee, and the Lord Chairman's request for the insertion of the clause in the Leatherhead

Bill, is that the Chairman of the Unopposed Bills Committee (Mr. J. H. Whitley) stated that, if the promoters had asked him not to insert the clause, he should have met their wishes. Apparently Mr. Whitley sees the injustice of the position, even though his colleagues may not. That is the only bright spot in the happenings of the past week in this connection.

There is another reason why the action of the Unopposed Bills Committee is inexplicable. It is that, when the chemical clause was inserted in the Annfield Plain Bill, Sir Harry Samuel (Chairman of the Select Committee) definitely indicated that they did not want the clause to be taken as a precedent for all future legislation; and he made it clear that, in the view of the Committee, every case should be decided on its own merits. The York Gas Company are now confronted by the Alkali Manufacturers' Association, who are asking for limitations being imposed on the Company, in favour of their own unlimited position. Against the setting-up of a monopoly by the means that the Alkali Manufacturers' Association are adopting, Mr. Honoratus Lloyd, K.C., protested in his opening on the Company's Bill; and Mr. Corbet Woodall deprecated very strongly the insertion in Bills of a clause of the character of the chemical one, seeing that the cumulative effect of them is to create precedents which handicap the industry very considerably. This and another remark made by Mr. Woodall suggest the question, Why are the Alkali Manufacturers' Association moving the powers that be to place this restriction upon small gas undertakings that are never individually likely to become chemical manufacturers? There is a two-fold answer. In the first place, the chemical manufacturers want to cripple these undertakings to an extent that will prevent any direct combination of concerns in the future for the purpose of working up residuals; and, in the second place, the more precedents they can get, the easier will it be for them in future to demand the insertion of the restricting clause in the Bills of gas undertakings that are in a position, or likely to rise to a position, to do their own tar-distilling, and to render assistance to their less affluent neighbours by purchasing their residuals at prices that are better than the chemical manufacturers may be prepared to offer, also perhaps saving thereby heavy transport costs. There is another reason, and it is this, that the prevention of direct combination and the deprivation of gas undertakings of residuals purchase powers, will leave the wealthy and heavy-dividend paying chemical manufacturers in the position of making practically what prices they like.

We need not again point to the evidence which shows that the present chemical clause, with or without the word "for," does not comprehend all the restriction for which the chemical manufacturers are fighting. This is only the beginning; and their Counsel and witnesses have made no secret of the fact. The position is one for the whole gas industry to deal with; it is a matter in which the whole gas industry should make some immediate move through their organizations. Any gas undertaking that meanwhile accepts any clause without fighting against it will be betraying the common interests of the gas industry.

Important Movement.

Since the foregoing article was written, we have received from the President of the Institution of Gas Engineers (Mr. R. G. Shadbolt) a copy of a communication that is being addressed to the gas undertakings of the kingdom, calling attention to what is taking place in the Parliamentary Committee rooms as the result of the movement of the Alkali Manufacturers' Association, and requesting the immediate assistance of the engineers and managers of all the undertakings that receive the communication. We are pleased to see an active start made in meeting the repressive and oppressive action of the combination of chemical manufacturers; and every gas engineer and manager will appreciate that there is no time to be lost. It is a case for effective, united, and—above all—*prompt* action. The Council of the Institution "view with considerable apprehension," the letter states, "the introduction of these restrictive "clauses, which are also being compulsorily inserted in "unopposed Bills." The Council are right in viewing the matter seriously. The Committee of the Gas Companies' Protection Association regard the matter in the same spirit; and the two bodies are therefore acting in unison in respect of it. The gas industry must, as a single body, back-up the Institution and the Association, in every possible movement, in the serious attempt to counteract this action of an outside wealthy body in interfering with the established affairs of the gas industry, and in getting the parliamentary authorities (as has already been partially and unjustly done) to put prohibitions on part of its business which may have a serious effect upon future developments. The first thing is to assist the Council by, at once, replying to the list of questions that they ask in their circular [reproduced on another page], and at the same time to encourage both the Institution and the Gas Companies' Protection Association, acting conjointly, to leave no stone unturned in meeting the present position. What is being done in the Committee rooms is to alter the law in regard to the residual products trading of gas undertakings at the instance of the commercially free chemical manufacturers. That must not be, if human effort can prevent it. Let us pull together in this matter, with the future of the industry well in mind.

Public Lighting and Flame Arcs.

An article that should be useful to all authorities considering the question of the improvement of the illumination of the streets, and the relative values for the purpose of modern gas and electric lamps—such authorities, for instance, as Manchester and Glasgow—has appeared in the "Electrical "Times," from the pen of Mr. Haydn Harrison. We know that the arc lamp industry has been having a bad time of it lately through the growing supersession of its productions by clusters of metallic filament lamps. Mr. Harrison has himself been responsible for changing over 1000 arc lamps during the past twelve months; and this, he says, has resulted in improved illumination and reduced cost. A point that is interesting is that, though most of the displaced lamps were of the open type, he likewise applies the statement as to improved illumination and reduced cost to the substitution, in the same manner, of flame arc lamps. He points out that no greater mistake was ever made than to imagine that because a lamp gives a powerful light at 40° to 60° from the horizontal, it can be used at long distances apart for street lighting. That is a matter upon which experience with flame arcs in the streets has clothed most of us with knowledge; as the density midway between such lamps is very real, and is intensified perspectively by the local bright patches near the lamps. But bring the lamps closer together so as to subdue the highly marked variations, and the result is an increased cost, and "a degree of illumi- "nation much in excess of that generally required for street "lighting." This is not new information; but there is here imparted to it the certification of one of the recognized illuminating engineers of the electrical industry.

Preference is given by Mr. Harrison to the metallic filament lamp in clusters for main street illuminations; and he gives it for a reason which applies very specially to the inverted gas-burner. It is that, by the use of spacious reflectors, placed adjacent to the filaments of the lamps, a large percentage of the upper hemispherical light can be reflected down to the 10° and 20° angles, and thus improve the distribution of the light. Now one of the defects of the upright incandescent burner for street lighting is due to the large proportion of upper hemispherical rays, of which the types of reflector generally employed do not make the best use in the matter of distribution. The reflectors applied to the upright incandescent burner can rarely find a scientific reason for their particular formation. Of course, in interiors where the vertical incandescent burner has the ceilings to reflect down the upper hemispherical light, the same criticism does not wholly apply. The inverted burner, however, has produced quite a new condition. We have by it the maximum light brought down to the lower hemisphere by means inherent to the lamp itself, and not by auxiliary means. Hence the reason why the high-pressure inverted lamp is superior to the flame arc lamp which Mr. Harrison condemns; hence, too, the reason why, in the official tests made by the Holborn Borough Council some months ago, it was found that, with inverted gas-lamps of a lower candle power than the metallic filament ones used in the experiment, the illuminating power along the centre-line of the street was greater midway between the lamp-posts in the case of the inverted gas-lamps than in that of the electric metallic filament ones.

There is a point in Mr. Harrison's article that requires amplifying somewhat. He says there is no doubt that efficient street lighting by means of tungsten lamps is the best means of introducing to the knowledge of the public

the enormous reduction in the cost of electric lighting that has been brought about during the last few years by the great improvements in incandescent electric lamps. We can hardly see how it can do this without enlightening figures are posted up on each lamp-post—among others, the charge per unit of electricity used for public lighting at the peak of the private lighting in comparison with the charge per unit to the private lighting consumer. If these figures were well advertised, the private consumers would wonder how Mr. Harrison came to the conclusion that the public lamps could be any guide whatever to them respecting the matter of economy.

Gas-Engine Inspection by Gas Suppliers.

PENETRATING beneath the surface of the paper read by Mr. R. Wardell, at the meeting of the Eastern Counties Gas Managers' Association last Wednesday, and of the discussion that succeeded, there is found an unexpressed but very obvious charge of negligence in parts of the gas industry in respect of its power business. The very fact that there was room for such a paper as the one that Mr. Wardell read, and which, it is hoped, will find its reward in the stimulation of more general protective action in the gas industry, constitutes in itself a remonstrance against apathy —not general, but still sufficiently prominent apathy to be more striking than its antithesis. What is very peculiar is that there is no reason for it. If the gas-engine industry had been standing still, and had not made progress, we could have understood the growth of a feeling that there was little to be gained by any strenuous opposition to the electric-motor, the suction-gas engine, and the oil-engine—all of which are pushed to the notice of manufacturers by keen and capable commercial agencies, with a talent for advertising the attractive lines of the characteristics of the engines they have for sale, while screening the less attractive ones. The gas-engine has progressed, as witness those beautiful examples of multi-cylinder engines that were at the Crystal Palace last year, generating electrical energy by town gas at a cost that had competed with the local electric supply. And going down to the lower powers, gas-engines have never been in such a state of simplicity and efficiency as they are to-day. The modern engine is as easy to start as an electric motor; and the subsequent reliability and economy are of a far higher order.

But where, in Mr. Wardell's opinion, the gas industry has hitherto failed, or (shall we say?) failed until quite modern times, has been in leaving, on a gas-engine being installed, the user to his own devices in relation to it, and the engine to the tender mercies of local fitters and others who possibly know very little of its mechanism and working, and of the combination of conditions that produces efficiency, economy, and satisfaction. Yet the local gas suppliers (who have a perpetual interest in the sale of the gas) are in a much better position, through their *locus in quo*, to give competent periodical attention to such engines, and to keep them properly "tuned-up," than the vendors of suction-gas plant or of oil-engines. By inaction, gas undertakings leave a widely-open door to their busy and fervid competitors. When competent examination and adjustment disclose the fact that there are gas-engines wasting up to 30 per cent. of their possible working efficiency, and 30 per cent. of the gas consumed, there is little room for marvel that subtle competitors find at times easy conquest. Such is the case. Therefore, Mr. Wardell advocates inspection and adjustment of gas-engines by men trained on the test-bed. We know that the engine insurance companies find that it pays to keep the engines insured with them under periodical observation for structural defects; and it should be just as important to gas undertakings to keep watch for efficiency defects arising. The prevention of the loss of efficiency may make all the difference between the success or otherwise of a competitor seeking to supplant a town-gas engine. Some gas engineers who have realized the importance of inspection and adjustment have found so much benefit in the result that they have taken the next natural step, and have entered upon the business of repair.

There are several factors that contribute to the disturbance of the maximum economy and efficiency of a gas-engine. Mr. Wardell points them out. His paper may, in fact, be taken as fairly covering the necessary instructions regarding the points that claim investigation and adjustment on the part of the gas suppliers' inspector. Of course, the inspector is not responsible for the necessary approximate constancy of calorific value. That is a matter for the gas engineer. But he can deal with all the other adjustable matters. He can see that a proper temperature is maintained (where electric ignition is not employed) in the ignition-tube; he can ascertain that there is a proper proportioning of the gas and air; he can, where it may be necessary, secure the proper governing of the gas supply, so that pressure is maintained at a fairly constant level; he can give attention to the temperature of the water-jacket; and he can see that the valve settings are in order. Of course, a governor would only be needed where there is likely to be any considerable variation of local pressure; and even then it would not be required if there was surplus power in the engine. However, upon accuracy in these matters, relies the realization of the best of which the engine is capable. A trained man competent to take indicator diagrams, and of appreciating the tale they convey, will have no difficulty in ascertaining whether or not an engine is working efficiently, and will have no difficulty, when any defect is revealed, in locating it, and in re-establishing those conditions. The case for inspection and adjustment of gas-engines that Mr. Wardell presents is complete, and valuable; and no one in the discussion was prepared to suggest that his proposition was not soundly and wisely conceived.

In the discussion, several points were made relative to the competition of the electric-motor. We do not think that any one in the gas industry would be so biassed as to suggest that there are not circumstances where the electric-motor has conveniences—such as for intermittent small-scale working, and for widely separated small-scale machinery in a single establishment—that endow it with a suitability that, distinct from cost, makes it the preferable form of motor to adopt. The discussion at the meeting, however, shows that manufacturers are awakening to the fact that, just as in the case of the suction-gas driven engine, so in the case of the electric-motor, experience does not fill in the alluring picture outlined by the subtle-tongued electrical canvasser. With steady loads and long-hour working, gas undertakings with properly adjusted gas-engines can, with town gas at anything between 1s. 6d. and 2s. per 1000 cubic feet, easily beat electric-motors supplied at $\frac{5}{8}$d. to 1d. per unit. Manufacturers are finding this out; and manufacturers are talking over the matter. Mr. T. Glover and Mr. A. E. Broadberry related some experiences bearing this out. The manufacturers, too, are finding, as the engine insurance companies have found, that, though the electric-motors that are in industrial use are juvenile compared with many of the gas-engines in service, the average cost of their repair is larger. An illustration given by Mr. Glover as to the success of a gas-engine in displacing electric-motors has an interest, apart altogether from the main fact, in that the electric-motors superseded by one large gas-engine were small, and were used for individual driving; and for the purpose of securing economy in running cost, and to compete with the gas-engine, the electricity suppliers themselves proposed to supplant the small electric-motors by one large electric-motor. This was a case where the load was a fairly constant one. But what of the boasted saving of shafting by adopting the electric drive, when, to compete in running cost with a gas-engine, the electricians have to suggest the installation of a large motor, and drive by means of a line of shafting? When a gas man enters into these matters with a protective and a fighting spirit animating him, he does not find the competitor such a formidable one after all. If the gas manager only asked himself why electrical energy is retailed at 0·5d. to 1d. per unit for power purposes, he would in some cases have to reply that the competitor evidently knows the strength of the gas-engine better than some gas men do. It is the strength of the position of the gas-engine that Mr. Wardell urges should be preserved by the reasonable means that are available.

Holder Construction.

GASHOLDERS and their structural features have been receiving more than ordinary consideration lately, chiefly through the Ilkeston gasholder disaster. In a paper by Mr. A. F. Young, of Bury St. Edmunds, read at last week's meeting of the Eastern Counties Association, various points in gasholder design were brought under consideration in connection with a reference to the Ilkeston accident. But, in this particular matter, Mr. Young did not contribute much to the general enlightenment as to the causes that produced the collapse. Although this will be the general conclusion, we are not prepared to subscribe to what appeared to be a

disparagement in Mr. S. Glover's remarks of the "unsolicited" examination of such a matter as this in the light of the evidence that has come direct from Ilkeston. All the fertile engineering minds in the world cannot be called in to investigate such a catastrophe as this one; and from a fertile mind at a distance a suggestion—a hint—might possibly be sent that might have a considerable effect in elucidating a mystery. We must not in these technical questions keep truth in obscurity by attempting to curtail discussion, or by narrowing the view.

Mr. Young was non-committal in dealing with this matter. He wanted to show a friendly side to the two parties with different solutions to the technical problem involved in the Ilkeston failure. On the one hand, there are those who say that the known "sequence of events"—the combination of events in this particular accident—was ample to produce strains of the various orders sufficient to cause the rupture of the steel tank, and that there was no defect in the tank-plates to account for their splitting. On the other hand, there are those who, from theoretical considerations, and the evidence advanced, are equally persuaded that the ruptured plates must have been the seats of some hidden weakness. Mr. Young amiably pats both parties on the back, and says: "If you amalgamate your views, you will "be about right." The calculations that were made by Mr. Ferguson Bell show an ample margin of safety in the thickness of the plates; but nevertheless Mr. Young emphatically says "there must have been some inherent weak"ness to make them give way as they did." He is not alone in this opinion. Mr. Young's conviction is that, when the "sequence of events" came into play, the tank-plates were under the influence of frost. Others have thought so too; but it is all of a piece with the rest of the speculation showered upon the unfortunate Ilkeston holder.

The author of the paper was a little bit confusing as to his views on the amount of refinement that he likes in the working parts of a gasholder. He does not regard with favour holders that rock about in such a way that wide pressure-gauge oscillations are shown; but he does like the steadiness of working of the spiral-guided holder. Yet he has an inclination for plenty of play between rollers and spindles, and is averse to the reduced laxity that has contributed to the making of the spiral-guided holder what it is. It is a little difficult to reconcile these views. Towards the end of the paper is a piece of real originality, and that is a device proposed by Mr. Young for automatically locking and unlocking the cups of gasholders. This attracted more interest than any other part of the paper; and it is hoped that the suggestion will not be allowed to sink from sight without further examination to ascertain whether or not it possesses the measure of utility which entitles it to a place in providing for the security of gasholders. Gasholder cups do become unsealed at times, but this is due more to cups that are too shallow, and to the laxity which Mr. Young favours in the working parts, and which the spiral-guided system has most effectually shown is capable of being eliminated. It is therefore a question whether it is not better to remove known defects by improvement than to attempt to cure them by an addition that may in itself serve as a fresh location for trouble, to say nothing of additional expense.

Condensation and Gas Temperatures.

Those who attended the informal meeting of Scottish gas engineers and managers last week had ample material provided for their discussion in the address delivered by Mr. James M'Leod, of Greenock. It was a thoughtful composition, and one that only comprised subjects upon which the author had something useful or instructive to say. The claim was properly made that Scotland was to the forefront in the matter of the use of vertical retorts for carbonization —in the shale-oil fields, if not in gas undertakings. But Scotland now bids fair, in the matter of proportion, to hold a position of early prominence in adoption for gas-making purposes. It will be a point of interest, however, to see which way Scotland will leap in the matter of the types of vertical retort that will be eventually installed, as the character of the Scotch coals have led Mr. Alex. Wilson to adopt, and Mr. W. R. Herring to experiment with, retorts and methods that follow a middle course between the continuous and intermittent systems. Still Helensburgh is not experiencing difficulty with continuous vertical retorts; and evidently other engineers in Scotland, judging by their recommendations, are not anticipating any trouble with the system. We are afraid, however, that Mr. M'Leod will have to be somewhat disappointed in regard to the coming summer producing information of a more definite character regarding the relative merits or otherwise of the various types of vertical settings. It does not appear to be likely that the subject will come upon the scene at the forthcoming annual meeting of the Institution.

A large part of the address was devoted to condensation; and Mr. M'Leod seems to be in search of a little more authentic information as to why some engineers prefer rapid cooling while the majority still practise slow condensation. Rapid cooling ought to prove itself to be the more scientific and economic method; and the reason why the slow process was developed so largely as the practice is simply the well-known one that by it more of the volatile hydrocarbons are retained in the gas. We incline to the opinion, however, that practice will gradually be transferred from slow to rapid condensation. The reason is not very far to seek. Slow condensation is the practice of years; but since its advent the conditions of manufacture have undergone such changes that the percentage of illuminating hydrocarbons in the gas is lower now than was formerly the case, and this percentage is so fairly stable that it will stand more drastic treatment in the way of condensation than that to which it is subjected to-day. Hence the ground for the view that the trend of practice will be from slow to rapid condensation.

An interesting experience is recorded by Mr. M'Leod in connection with the undue dropping of the temperature of the gas at Greenock before entering the purifiers, owing to the scrubber and exhauster being closely situated. The drop was such that, to ensure efficiency in the purifiers, it was necessary to raise the temperature of the gas before entering the boxes. A length of exposed pipe between the scrubbers and the purifiers enabled the construction over it of a fire-brick chamber into which steam is led, resulting in the heating-up of the gas, which enters the purifiers at a proper temperature. Mr. M'Leod leads us to another interesting phase of gas temperature, and one that, so far as we remember, is novel. This has reference to distribution temperatures. There has been comparatively little work done in this direction; but such as there has been, has pointed to a material variation between the temperature at the works and at a distance in the district. Now Mr. M'Leod's experiments lead him to the opposite conclusion. He does not find that there is really any great difference between the temperature at the outlet of the works and a distance away in the district; and he is of opinion that, if the gas was given a good start from the works in the matter of temperature, it would maintain the temperature fairly well in the district, and be delivered to the consumers at almost constant temperature. The advantages suggested are: Decrease in the amount of gas unaccounted for; more regular working of gas appliances; and possible decrease in the amount of naphthalene deposit. Despite these advantages, there is doubt as to whether the suggestion will be seriously regarded by many engineers. Towns and districts differ. Mr. M'Leod's experience might not be that of his neighbours. Gas-mains are, or rather most of the older ones are, laid at a depth under the surface that comes within the influence of the rapid and wide changes of surface temperatures, so that just at the coldest part of the year and in the coldest parts of the kingdom, when it was hoped to maintain the temperature, the warmed-up gas would be subject to drastic treatment the results of which might not be of value to anyone. However, this is (similarly to the other points of the address) an interesting matter, the investigation of which would be sure to supplement knowledge. We hope Mr. M'Leod will follow it up, and say more about it.

Small Towns and Electricity Speculation.

The Aylesbury District Council have at the present time, as many other local authorities of small-sized towns have had to their after-regret, an attack of electrical fever, which may progress—unless they give ear to reason, and profit by it—until an electricity supply plant is laid down, and then the same old tale will begin to be spun, financial disaster will ensue, the ratepayers will be called upon to find money to support the undertaking, and there will be remorse on the part of those who are blindly leading the town into the planned speculation. That is what has generally happened with municipal electricity undertakings in small-sized towns. It will happen in Aylesbury, unless the town is blessed in some extraordinary manner. The Council visited

old-world Chichester, where the electricity supply is in the hands of a company, and not of a local authority; and those interested in the electricity business of the city have done their best to encourage Aylesbury to take up municipal trading in electricity supply. Correspondence *pro et con* has appeared in the "Bucks Herald." The Engineer of the Chichester Electric Supply Company (Mr. Weare) tried the old-fashioned method, to stiffen the position for the Aylesbury Council, of quoting certain aggregate figures to show what a magnificent business is electricity supply. But whole figures sometimes cover a multitude of sins. The sins these electrical figures conceal from the eyes of laymen are that loan repayments, depreciation, and reserves, are improperly provided for—even taking the electricity supply industry as a whole. Another sin is found in Mr. Weare (he ought to have known better) trying to obscure the truth from the Aylesbury ratepayers in this way—by taking the whole figures, the position of those local authority concerns operating in towns of a size of that of Aylesbury is not disclosed. Mr. T. Ebenezer Pye, the Engineer and Manager of the Chichester Gas Company, saw this defect in Mr. Weare's case; and he has put forward the true financial position of such concerns in the "Bucks Herald." We will not venture to quote the figures here; the main ones are reproduced in our "Miscellaneous News" columns to-day. They should make the Aylesbury Council pause when they see the bitter financial experience that other local authorities have had in towns with which Aylesbury can compare; and such towns are the only proper guide for Aylesbury. It is a good case that Mr. Pye presents. He compares like with like. Mr. Weare did not; and now it remains for this gentleman to wriggle the best way he can out of the false position in which he has placed himself by using statistics that have no right to be applied to conditions at Aylesbury. This is not by any means the first service that Mr. Pye has performed for the gas industry beyond his own immediate sphere of professional activity. He has also been a strong advocate of publicity; and perhaps the salient, and most far-reaching, act of his life was when he proposed, in the Commercial Section of the Southern District Association, the resolution regarding co-operative publicity that led to the foundation of the British Commercial Gas Association.

Tar Products Prices.

For years we were buffeted mercilessly over the prices that appeared in our residuals products market reports. Some correspondents regarded the figures given for tar products as too high; some as too low. There was no pleasing our correspondents with opposing interests, though the figures in the reports are supplied by correspondents in direct touch with the markets. Then to meet the difficulty, a table was compiled from figures supplied by representative manufacturers "as fair current values" for the week preceding publication. This table has been appearing now for some time in our pages; but the information contained in it has not always given universal satisfaction. But lately there has been a little compensation for the difficulty there has been with correspondents. The coal strike and the transport troubles have so considerably interfered with the tar business that reliable prices have been out of the question; and therefore the table has not been published during the disorganized conditions. The cessation of publication, however, has brought to us, from many quarters of the country, inquiries as to why the table is now omitted, and expressions of hope that it will soon be resumed. After the grumbling over prices that we have to contend with, these letters are a satisfaction in that they show the interest that exists in the published prices, and the value that they are to many of our subscribers. The resumption of publication of the table will take place as soon as ever the sources of information are of opinion that conditions are again sufficiently normal to justify the compilation and circulation of the figures.

Companies' Balance-Sheets.

The question as to whether a particular balance-sheet complied with the requirements of sub-section 3 of section 26 of the Companies (Consolidation) Act, was the subject of a test action in the Divisional Court a few days ago. It was in the form of a special case stated by the Stipendiary Magistrate of Manchester, and raised the point as to the degree of details the Statute requires in the balance-sheet annually to be furnished to the Registrar by the limited liability company concerned—a firm of Manchester merchants. The sub-section of the Act under which the matter arose is in the following words: "The summary must also (except where the company is a private company) include a statement made up to such date as may be specified in the statement, in the form of a balance-sheet, audited by the company's auditors and containing a summary of its share capital, its liabilities, and its assets, giving such particulars as will disclose the general nature of those liabilities and assets, and how the values of the fixed assets have been arrived at; but the balance-sheet need not include a statement of profit and loss." It appears that the contention was that, inasmuch as the company's balance-sheet gave the aggregate value of goodwill, trade marks, buildings, machinery, furniture, fixtures, and fittings, in one amount, without stating how much of this was represented by goodwill and trade marks, and how much by buildings, &c., it did not disclose the general nature of the assets. It was, however, pointed out in the balance-sheet that the goodwill and trade marks were taken at the value at which they were acquired, and the other items at a valuation. The company contended that they were within their rights in lumping together all the intangible and tangible assets; and the Magistrate decided that the balance-sheet as filed sufficiently complied with the Act. It was against this decision that the Board of Trade appealed; and they were successful—the Court unanimously holding that the balance-sheet did not sufficiently comply with the section. Referring to the matter, a correspondent of the "Financial News" says that, though the Court took care to state that they were dealing only with this particular balance-sheet, and that any future case would have to be dealt with on its merits, there can be little doubt that the general effect of the decision "will be that goodwill and the like must be separate from buildings, machinery, and similar property in the filed balance-sheets, inasmuch as these two classes of assets are usually valued on different principles; and there can be equally little doubt that such a decision is in the interests of the financial public."

Personal.

Mr. B. A. CARPENTER has been appointed to the position of Secretary and Manager of the Sheppy Gas Company, in succession to Mr. Henry Barber, who died last January.

Mr. H. G. RUGGLES, who is at present Manager, Engineer, and Secretary to the Irthlingborough Gas and Coke Company, Limited, has been appointed Secretary and Manager to the Leighton Buzzard Gas Company, in succession to his father, whose death was lately recorded in our columns.

The Clonmel Corporation have approved of a recommendation by the Gas Committee that Mr. RICHARD KNEESHAW should be appointed Gas Manager, in place of his father, who retired recently on a pension. It may be recalled that, when the vacancy arose, Mr. Isaac Carr, of Widnes, in his capacity as Consulting Engineer to the Corporation, was asked for advice; and ultimately the name of a candidate was submitted for approval. The Council, however, as a body did not agree with this selection; and the matter was later taken in hand by a new Gas Committee, who advertised for applications in the local papers. In response, three offers were received; and from among these the choice fell (in accordance with the wishes of the majority of the Council) upon Mr. Kneeshaw, who had previously assisted his father in the management of the works.

New Livesey Professor of Coal Gas and Fuel Industries.

We have received from the Vice-Chancellor of the University of Leeds the following announcement: On the recommendation of the Livesey Memorial Committee, the University Council have appointed Mr. John William Cobb, B.Sc., to be Livesey Professor of Coal Gas and Fuel Industries from the end of the present academic year, when the Chair will be vacated by Dr. W. A. Bone, F.R.S., who has accepted the professorship of Fuel and Refractory Materials at the Imperial College of Science and Technology. Professor Cobb, who was born in 1873, received his early education at the Leeds Modern School, and is a former Scholar and Prizeman of the University of Leeds and Exhibitioner and B.Sc. of the University of London. Since 1891, he he has been engaged with the Farnley Iron Company—in the first instance as Chemist, and more recently as Technical Assistant to the Managing-Director, Mr. R. Armitage, M.P. The control and development of fuel-using processes at the works of the Farnley Iron Company have been largely under Mr. Cobb's control, especially since the introduction of the Mond gas process with ammonia recovery, of which the Farnley Iron Company was one of the first users. The gas has been brought into service for furnace heating and for burning glazed ware, as also for power through gas-engines. Professor Cobb has made many contributions to scientific journals—mainly of a technical character—concerning coal, the working of furnaces, the testing of clay ware, the constitution and synthesis of glazes, and the corrosion of iron.

NOTES FROM WESTMINSTER.

Alkali Manufacturers' Opposition.

Since the Easter Holidays, work has got into full swing again in the Committee rooms; but there is not a great deal that affects our readers, as the bulk of the Gas Bills are passing forward unopposed. The Standard Burner Bill is going through without opposition. We thought it would be strange if any local authorities came to Westminster this year on the same foolish and expensive errand as did certain local authorities in 1910. The section of the Birmingham Corporation Bill bearing upon the acquisition of further land for the construction of gas-works has been passed by one House; and the Local Government Board have been given the power to grant loans and to fix the terms of repayment. Much the same has happened in connection with the Belfast Corporation Bill, which contemplates new gas-works that will cost the round sum of £400,000. These big works schemes will make the mouths water of some of our contracting firms. Extensions of works have not been on the large scale for some time past, though most of the contractors report plenty of work in hand. But the industry is making fresh spurts in gas-supply business; and with the developments that are taking place, it is pretty clear that we must be about at the brink of fresh activity in the matter of new gas-works construction. There is one thing about current proceedings in Parliament that we do not like; and that is the position of the residuals products business in connection with the opposition of the Alkali Manufacturers' Association. But regarding this question a special article appears in our editorial columns; and it will be seen there that the matter has become one that the gas industry must follow up with the least possible delay.

York United. At the close of the week, the York United Gas Company's Bill had been under the consideration of Lord Barnard's Committee; but the promoters' case had not finished. Altogether, with its many features, the Bill is an interesting one. The discussion before the Committee has been instructive, in that it shows how opponents may have large ideas, with nothing to support them in the shape of grievances against a Company. There is little to be said against a maximum-price Company who are supplying gas at 2s. 2d. per 1000 cubic feet. The York Company want to make, as it were, a fresh start. They propose to consolidate their existing Acts. Voice cannot be raised against such a desirable course. They desire to extend their limits of supply, so as to include an area seven miles from the centre of the city—a proceeding that Mr. Corbet Woodall says is an advisable one. They ask for additional capital; and to transform themselves from a maximum-price to a sliding-scale Company. They also seek permission to reduce the illuminating power standard, and to adopt the No. 2 test-burner, in conformity with modern practice. The Company were beforetimes a 14-candle standard concern. They merely ask to be so again. In view of their becoming a sliding-scale company, in view of the course of events in the use of gas, and in view, too, of the practice of Parliament, there is nothing of value that can be advanced against this proposal. However, the Alkali Manufacturers' Association are in opposition. They think it worth while running up a big bill in fighting the gas industry to restrain any development in the working-up of its own residual products. These Alkali Manufacturers are far-seeing people. The present parliamentary position in respect of this matter should, as will be seen from an article in earlier columns, receive very careful consideration indeed. Then the York Corporation are in opposition suggesting, among other things, that (though they are the owners of the electricity undertaking) they have arrived at the conclusion that it would be an excellent thing for the gas undertaking to also become municipal property. Of course, the Corporation have not so far come to any conclusion of a nature on which Parliament ought to act. Lord Barnard told Counsel that there was no evidence before the Committee that the Corporation had ever seriously discussed the matter, though it was mentioned in the petition. What is wanted is that something in the nature of a suspensory clause should be put upon the Company, so that the question may be raised during the next few months. First, a suspensory clause; then a Bill in Parliament; and then an arbitration—well, this sort of thing makes a run of work for the promoters of the acquisition of private enterprises by public bodies. The financial position of the Company was fully stated by Mr. Honoratus Lloyd, K.C., and enlarged upon by Mr. William Cash, F.C.A. A point of much discussion has been the desire of the Company to have the new capital on a 7 per cent. basis, as they find that 4 per cent. capital is not attractive in these days. The 7 per cent. will not make the slightest adverse difference, as the higher the standard dividend the higher premium the capital will command. The Chairman stated his view to be that, if the Company desired 7 per cent. capital, they might have it. The Company are now selling gas as a maximum price Company at 2s. 2d.; and they asked in the Bill as drafted for a 2s. 10d. standard. But their advisers thought this somewhat high; and it was altered to 2s. 6d. The Corporation do not want them to have 2s. 6d. As a matter of fact, they do not appear to want to let the Company get any further advantage from the management of the business. However, Mr. Corbet Woodall came to the rescue, and suggested that between 2s. 6d. and 2s. 2d. should be a neutral zone without variation of dividend, or 2s. 4d. be the standard without a neutral zone. The Company certainly ought to have a margin of price before there is any interference with their present mild rates of dividend. Their past and present modesty seems to be regarded by the Corporation as a good reason why they should be penalized in future. It is exceedingly difficult to appreciate the position of the Corporation. As to the opposition of property owners, they desire the works moved from the present site to another quarter; but Lord Barnard regards this as an extensive order.

Restricting Municipal Borrowing. An article appeared in the "Journal" for April 9 (p. 86), calling attention to the fact that the session was passing along, and the parliamentary authorities were not pursuing the work of financial restriction in the matter of municipal trading concerns that the interests of communities demand. The Milford Haven District Council had its powers of borrowing curtailed last session, in order that the Council, in respect of its administration of the gas undertaking, should have the pleasure of coming before Parliament periodically to have its powers reviewed, and to ascertain how far the obligations imposed upon them had been observed. Now the Ashbourne District Council who are before Parliament this year with a Gas Purchase Bill have had their borrowing powers limited under the Bill to £5000 for extensions (there was no limit in the Bill), for the express purpose of compelling them to come to Parliament in a comparatively short time, and so give the outside authorities an opportunity of opposing if the undertaking has not been carried on to the satisfaction of consumers. The Council asked for forty years for the repayment of the purchase money; they have got 35 years. They asked for such loans and repayment periods for new works as the Local Government Board might direct. The amount of the loan as mentioned has been restricted; the period of repayment has been limited to 28 years. Why did not the parliamentary authorities at the same time limit the sum of money that could be transferred from profits in aid of the rates, or better still decline to allow any such appropriation, and make the undertaking responsible for any indebtedness to the rates? Parliament would have been doing a service to, and ensuring justice for, the gas consumers of Ashbourne.

Special Protection. Touching the question of the efforts of County Councils and other road authorities to obtain special terms from gas companies in regard to the user of roads by bringing the pressure of a threat of opposition to Bills to bear upon them, attention may be directed to some remarks made by Sir Edwin Cornwall in connection with the Staffordshire Potteries Water Bill. He does not think it fair that promoters of Bills should agree with railway companies or other bodies and give them clauses which are in excess of the common law of the land; and he considers it wrong that Parliament should go out of its way to protect a great railway company who can well protect themselves at common law. Sir Edwin is going to draw the attention of the parliamentary authorities to the matter. While he has the subject fresh in mind, he might also bring to their notice the hostility shown by county councils last session to gas companies who would not concede to the councils concerned privileges in excess of their common-law rights in the matter of pipes and steam-rollers.

Water Measures. There have been some important water measures before Committees the last few days. The Local Legislation Committee have passed the Bill that is to confer upon the District Council of Tavistock the right to purchase the water and market undertakings in the town, at present the property of the Duke of Bedford. There is also the Staffordshire Potteries Bill, which started its parliamentary career with seven petitions against it. These were reduced to one; and the proceedings before Sir Edwin Cornwall's Committee had not advanced far when agreement was effected with this solitary opponent. The Company supply an area of 235 square miles; and the measure is for new works and capital—the additional powers sought in the latter respect being £240,000, of which the new works will require £198,033. The Company also desire, as is customary since the Frimley decision, to have legalized their acts in sinking wells upon land purchased by agreement. The preamble has been declared proved. In face of heavy opposition, the Fylde Water Board have carried their Bill through the Commons Committee. Their case was well prepared and excellently handled; and they satisfied Sir Charles Rose's Committee on every point. The Board have a large area depending upon them for water—Blackpool, Fleetwood, Lytham, St. Annes-on-Sea, and to boot some 42 small townships. Their responsibility is great; and this responsibility is reflected in the scheme that they laid before Parliament. The Board proposed new works in the area drained by the River Hodder, in the Easington and Croasdale Fell districts. Four reservoirs and 28¼ miles of aqueduct, at a total cost of 1¾ millions sterling, with a net yield, after deducting compensation water, of 16½ million gallons, are the main outlines of this large enterprise. An agreement was struck with the Blackburn Corporation, in an arrangement cutting Croasdale out of the Bill, and leaving it a neutral area, or more probably a "bone of contention" for a future parliamentary tussle. The Preston Corporation considered their dock and harbour would be injuriously affected by the new works reducing the scouring power of the river. The evidence given, however, was overwhelmingly in favour of the scheme; so through it has gone.

The Scottish Junior Gas Association (Eastern District) will next Saturday visit the works of Messrs. Stewarts and Lloyds, Limited, at Coatbridge.

PRESENTATION TO MR. CORBET WOODALL.

THERE was a pleasing ceremony at the Beckton Gas-Works last Sunday week, when Mr. Corbet Woodall was presented with a silver-gilt casket subscribed for by the workmen in the manufacturing department. The casket contained a signed scroll bearing the following inscription:—

> We, the workmen employed in the carbonizing and oil-gas departments of the Beckton works of the Gaslight and Coke Company, take this opportunity of expressing to you our great respect and esteem, and beg your acceptance of the accompanying casket as a small token of our appreciation of the many benefits enjoyed by us, and as an expression of our dutiful loyalty to you and the Company.

There were several hundred subscribers present at the gathering; and the chair was taken by Mr. J. N. Reeson, the Engineer of the works. Those attending, in addition to Mr. Corbet Woodall, included Mrs. Woodall and Miss Woodall, Mrs. Reeson, Mr. and Mrs. Thomas Goulden, Mr. J. S. Thorman and Mrs. Thorman, and Mr. A. H. Solomon.

Mr. REESON opened the proceedings by giving a hearty welcome to Mr. and Mrs. Corbet Woodall, and said he thought an apology was due to them for asking them to come there on a Sunday morning. It was a very happy day indeed for him (Mr. Reeson); for it saw the fulfilment of a hope he had long had—namely, that the workmen should, on their own initiative, offer some recognition to Mr. Corbet Woodall of all they owed to him. Though the address about to be presented came from a comparatively small portion of the employees at Beckton, he would not like the Governor to think the other employees lacked in any way the same feelings of affection and loyalty to him. He would rather have the Governor think that the same happy thought which had prompted the carbonizing and oil-gas men did not occur to them; and he could assure the Governor, from his own personal knowledge, that they regretted exceedingly that they did not have the happy inspiration. They all owed much to Mr. Corbet Woodall; and it was difficult for him (Mr. Reeson) in any adequate sense to voice their deep feelings of gratitude for what they all owed him personally. Though the address was primarily suggested by the outcome of what happened last year, he would have the Governor believe that they were animated by far deeper feelings than those—feelings of very deep and sincere affection.

Mr. A. LAVIN, in making the presentation, expressed the fear that he had not at command words which would convey their opinions in the way they would wish it done. The gathering that morning was a sequel to a meeting he and other men had with the Governor at Westminster last year, to ask for an increase of wages. At that meeting they received courtesy, consideration, and concessions greater than they expected. They also received assurances and encouragement to bring their grievances before the Governor, and of his willingness to remedy them. Not on that occasion only had they been made aware of his great kindness and consideration. Since he had been at the head of the Company, they had observed his generous efforts to better their conditions. They had noticed his sympathy and generous aid to the men when in sickness and distress. The co-partnership scheme had brought them more in contact with the Company, and had enabled them to become what they were that day, to say nothing of the nest-egg and great bonus that was growing for them year by year, and which was something to which they could look in their old age. These were matters which they could never forget. What they had to offer to Mr. Corbet Woodall that morning was not of itself of large value. It was, however, valuable because it came spontaneously and from their hearts. It was also valuable because in these days of labour troubles such an event was rare. It was given as a mark of affection and esteem. They all hoped that the existing good relationship would continue. When they first approached Mr. Corbet Woodall on the matter, he suggested that they should use the money in order to buy a bed for the hospital; but this would have meant that the Governor would have to subscribe to his own testimonial, and they could not consent to that. He then handed the Governor the casket, and said it was the proudest moment of his life.

Mr. CORBET WOODALL remarked that he found it very difficult to say what he would like to in response to the eloquent and admirably chosen words in which Mr. Lavin had made the presentation. He thanked them for the beautiful gift; but he thanked them still more for the kindly and happy thought which suggested it. Mr. Lavin was quite right in what he said. He was right in saying that a gift was of value in proportion as it was rare; and he regretted to agree that Mr. Lavin was absolutely right in saying that occasions of this kind were rare. For himself personally, he rejoiced in this meeting. He must say that there was no place, with one reservation, where he felt more at home than at Beckton. This was not only because he enjoyed the work which went on there, but also because whenever he came there he felt, and increasingly felt, that he was among friends. The association that he had with Beckton was now one of some considerable number of years; and it had been of growing satisfaction and pleasure to him. It was a pity, he thought, in one way that, when he had had the pleasure of meeting the employees of the Company, it had almost invariably been borne in upon him that he must talk about wages and the relationship between employers and employed. But, after all, this was the relationship which drew them together. The present was a time of great difficulty and trouble. There was a movement afoot throughout the whole of England—he was not sure that it did not exist throughout Europe—for the readjustment of the relations between employers and employed. There was a controversy in the "Times" just now in which a well known and much-esteemed Bishop of the Church of England laid down, among other proposals, that the first charge upon industry was the adequate recompense of the workers engaged in the industry. He (the Governor) need hardly say that he endorsed this opinion absolutely. This, however, was not so simple a proposition as it appeared on the face of it, because he was not quite sure that they would all agree as to what was adequate. But, at any rate, they were all of one mind that an industry should be so conducted that it gave an income sufficient to keep a man and his family in a condition in which his work should be the best that was possible. It was no economy, from the point of view of the employers or of the country, that the income of those who worked with their hands should be insufficient to maintain the worker in efficiency, or that the children should not be nourished and brought up in healthy and happy homes. They had always as a Company regarded this as the first burden on the industry; but the difficulty was to arrive at the question of adequacy. He hoped they were all of one mind there that the method which had been employed during the last six weeks was not an ideal method for arriving at a satisfactory understanding. The suggestion that the mere brutal trial of strength of one against the other should be the only way in this twentieth century of coming to an agreement affecting the health and happiness of so many, was an insult to the intelligence of the age. At their rifle club supper he had suggested that there should be arbitration, and that had taken place, but not until after they had passed through much trouble. The miners themselves had a certain amount of income during the progress of the strike; so that they were not the chief sufferers by it. Were the owners? To them it might possibly mean a slight reduction in their income for a few months; but this did not affect them greatly. They suffered practically nothing at all; but those who had no direct interest in the strike were thrown out of work, and had to bear the burden of suffering and of sorrow. Was it fair, was it reasonable, was it decent that differences should be followed with results such as these? The salient fact of the recent strike had been very much of this character. What he wanted to urge upon them was that the thing they ought all to aim at was that they should do the best that was in them for themselves and for those who occupied the position of employers. There should be no grudging services; but they should all try to do the best they could, and having done this, then he held that every man had a right to stand up and say, "I have done my best. I have given yeoman service to the Company; let me be paid in proportion to the duty I have performed." He thought they would agree that, whatever had been the success of the co-partnership scheme, in the principle of co-partnership lay the way to the perfect harmonization of the interests of all. Upon this he had no sort of hesitation. There should be a common interest—each for all, all trying to do their best. The one way in which they could ensure the maintenance of the measure of prosperity they enjoyed that day was that they should improve their manufacture, and reduce its cost. After all, there was something more than money; and he believed that the system of co-partnership tended to make them see the best there was in the things about them, and enjoy the sense of having done their duty. Let them all try and respect each other—believing in one another rather than fighting each other; and he believed the future of the undertaking would be as happy as he was glad to think it was that day. In the matter referred to by Mr. Lavin, he would have them remember that he was only one of the Directors; but they were quite willing to support him. He would also like to say that in all things he had received the cordial assistance of the chief officers of the Company.

The proceedings closed with hearty cheers for the Governor and Mrs. Woodall.

EARLY DAYS OF THE BRITISH ASSOCIATION OF GAS MANAGERS.

Founders and Pioneers in Central Organization in the Gas Industry.

THOUGHTS will turn in spare moments to the Jubilee Year of the Institution of Gas Engineers; and naturally from the Jubilee Year to the early days. The reference in last week's editorial columns to the honour that the Council propose to confer upon Mr. Thomas Newbigging—the "father" (may we not say to-day?) of the gas profession—by presenting him with his portrait in oils, has caused one to glance back at the proceedings recorded in our columns of the preliminary meeting held on Dec. 15, 1863, at which the British Association of Gas Managers was founded. We said last week that Mr. Newbigging became a member in 1864; but this glance back shows that he was actually at the very inception of the Association on the date named above. The old age-soiled report before us states:

> At a preliminary meeting of gas managers, convened by circular, and held at the Royal Hotel, Manchester, Dec. 15, 1863, for the purpose of discussing the d sirability of forming a "British Association of

Gas Managers," the following gentlemen, being engineers or managers of gas-works, were present.

Mr. Adamson, Leeds.	Mr. Simpson, Rugby.
,, Paterson, Warrington.	,, Fingland, Todmorden.
,, Dyer, Burton-on-Trent.	,, Whitaker, Brighouse.
,, Fraser, Loughborough.	,, Larkum, Ripon.
,, Leather, Burnley.	,, Cleland, Liverpool.
,, Wood, Bury.	,, Brandwood, Radcliffe.
,, Hutchinson, Barnsley.	,, Green, Heckmondwike.
,, Cathels, Shrewsbury.	,, Rowe, Wrexham.
,, Blackburn, Droylsden.	,, Newbigging, Bacup.
,, Martin, Ormskirk.	,, Dand, Buxton.
,, Forsyth, Sowerby Bridge.	,, Hall, L. & N. W. R. Coy.
,, Broadhead, Grimsby.	,, Owst-Atkinson (Lessee).

A great number of letters were received from other persons, regretting their inability to be present, but testifying their approbation of the objects of the meeting.

From this, it appears that Mr. Newbigging was one of twenty-four engineers or managers present when the Association (which has now developed into the Institution of Gas Engineers) was formally started. As a matter of fact, for some months prior to this meeting in 1863, Mr. Newbigging was one of the moving spirits, along with Mr. James Blackburn, of Droylsden, in arranging the promotion of the Association; and he attended the earlier meetings (at which only about six or seven were present) at the Royal Hotel. Gas managers, being wide apart, it was not, of course, possible for them in those days to confer together very often; but Mr. Giles (Messrs. W. & B. Cowan's traveller, who afterwards became a partner with Mr. Cowan) acted as a sort of go-between, as he moved from town to town, and carried intelligence as to the proposal from one to the other. Mr. Newbigging had considerable correspondence with him, and with some of the managers on the subject; and the preliminary meeting (convened by circular) on Dec. 15, 1863, was the result of the conferences and conversations. Mr. Newbigging was, therefore, in the forefront at the initial stages of the movement for the national organization of the gas profession.

TRIBUTE TO AN INVENTOR.

Mr. Stephen Holman and his Work.

With the confident anticipation that it will meet with the cordial support of those connected with the gas industry, it is a pleasure to draw attention to the fact that a life-size portrait in oils and an appreciative tribute in " coin of the realm " are to be presented to Mr. Stephen Holman, in recognition of the great services he has rendered to gas undertakings during the past forty years. In explanation of this excellent proposal, it may be remarked that it has been ascertained that Mr. Holman has not had his reward in the shape of royalties from the users of his three well-known patents in connection with Morton's self-sealing gas-retort lids, nor has he participated in the profits accruing to the various British and foreign makers of his inventions upon whom he has had no claim for royalty, because the term of his patents expired in 1888, and his business income ceased on the termination of his partnership a quarter of a century ago. In the manner now suggested, all companies and local authorities who are using Morton's self-sealing lids and Holman's lid-carrying crossbars and eccentric lever hinge-pins for quickly opening, closing, and fastening the non-lifting and non-luting lids to the mouthpieces (of which, it is estimated, there are at least a quarter of a million employed), will have an opportunity of showing their appreciation of Mr. Holman's work in a practical manner. The limits of the subscriptions are between one guinea and twenty guineas; so that both large and small undertakings may be included in the fund to be raised. Mr. Morton's lid and the date of his patent will be incorporated in Mr. Holman's portrait in oils, to be painted by Mr. H. St. Pierre Bunbury, Exhibitor in the Royal Academy.

Mr. Holman has had a long career in the engineering world—beginning in 1841, when (preparatory to his apprenticeship) he was placed as an assistant in connection with the pumping plant at a Cornish mine. Between 1854 and 1882, he took out no less than eighteen patents; and his latest one is dated as recently as last year—for a rigid eccentric sleeve adjustment for Morton lids. In 1862, he rented offices in Cannon Street, and represented several well-known English firms—among them Messrs. Tangye Bros., of Birmingham. Five years later, this agency merged into a partnership, under the title of Tangye Brothers and Holman. Before patenting his retort-lid fastenings, Mr. Holman had had charge of a gas-works, and had foreseen the value of non-luted lids, if they were successful. He therefore entered into an agreement with Mr. Morton for the sole manufacture of his non-luted lids, and took out patents for fastenings for them. The combined working of mechanical stokers, self-sealing retort-lids, and double eccentric lever fastenings have, it is pointed out, made it possible to discharge and re-charge sixty retorts per hour, which would be impracticable with luted lids and manual stoking. An approximate estimate of the saving to gas undertakings by the use of modern non-luted lids is given in a circular issued some time back by Mr. Morton—namely, £50 a week in a retort-house containing 250 through retorts. He further calculated that the aggregate saving to undertakings by using Morton's lids and Holman's fastenings exceeds £1,000,000 per annum.

The London and Suburban gas companies have already contributed generously towards the object in view; and a universally known gas engineering firm in Manchester have also given a substantial amount, together with an appreciative testimonial regarding the Holman retort-lid fastenings. In urging others to do likewise, we would mention that cheques should be made payable to the " Gas Companies' Tribute to Mr. Holman," crossed National Provincial Bank of England, and addressed to the Manager, National Provincial Bank, Cromwell Road, South Kensington.

CHEMICAL MANUFACTURERS' OPPOSITION TO THE GAS INDUSTRY.

Immediate Action Necessary.

In our leader columns, information is given as to the new position that has been created in the Parliamentary Committee rooms, by the Private Bill Authorities compulsorily inserting the restricting clause obtained by the Alkali Manufacturers' Association (in the South Suburban, Annfield Plain, and Fleetwood Gas Bills) in unopposed Bills, *without giving the promoters any opportunity of considering the matter.* The iniquity of this proceeding is manifest; and it cannot be allowed to continue, and the gas industry remain passive. The future interests of the industry in the matter of their residuals business are menaced. The chemical manufacturers have got in the thin end of the wedge; and the evidence shows that they intend to drive it further.

The Institution of Gas Engineers and the Gas Companies' Protection Association are taking up the matter in the name of the gas industry; but they desire the support of the gas industry in defeating this action on the part of the Alkali Manufacturers' Association, and the Private Bill Authorities in Parliament.

The President of the Institution (Mr. R. G. Shadbolt) has, as a first step, addressed the following letter to the gas undertakings of the United Kingdom; and to the questions accompanying the letter an *immediate reply* should be given. Time must not be lost. There is one word of warning. It is important that no one in a responsible position in connection with a gas undertaking shall be cajoled into believing that the position is not so serious as is represented.

THE INSTITUTION OF GAS ENGINEERS.

39, Victoria Street, S.W.,
27th April, 1912.

Alkali Manufacturers' Association's Opposition to Gas Bills. Session 1912.

Dear Sir,—In consequence of the strenuous opposition being offered by the Alkali Manufacturers' Association to all Gas Bills in this session of Parliament, whereby a clause has already been imposed on the South Suburban and other gas companies, restricting them from purchasing residuals from any other gas undertaking, the Council of the Institution view with considerable apprehension the introduction of these restrictive clauses, which are also being compulsorily inserted in unopposed Bills.

The Council, acting in conjunction with the Gas Companies' Protection Association, are taking steps to combat this movement, and if you will kindly reply to the enclosed list of questions, at the earliest possible date, it will greatly assist them.

I remain, yours faithfully,
R. G. Shadbolt, *President.*

[Copy of Enclosure.]

Alkali Manufacturers' Association's Opposition to Gas Bills. Session 1912.

1. Do you make up your gas liquor into sulphate of ammonia or concentrate?
2. Do you make sulphuric acid?
3. Do you distil your tar or prepare it for road purposes?
4. Do you purchase ammoniacal liquor, tar, or spent oxide from any other gas undertaking?
5. Do you sell any of the alkali products to any other gas undertaking?
6. If you sell your residuals to chemical manufacturers, is there any real competition for them?
7. Have you any legal restrictions against:
   (*a*) Using up your own residuals?
   (*b*) Buying residuals from other gas undertakings to be worked up along with your own?
8. If you have any other information to give that may be of assistance, please state it here.

Urgent.—It is particularly requested that this form be returned to the President, Institution of Gas Engineers, 39, Victoria Street, Westminster, S.W., without delay.

CONCILIATION (TRADE DISPUTES) ACT.

THE ninth report by the Board of Trade of proceedings under the Conciliation (Trade Disputes) Act of 1896, covering the year 1911, has lately been issued, bearing the signature of Sir G. R. Askwith, K.C.B., Chief Industrial Commissioner. The Act provides for the registration of such Conciliation Boards as are constituted for the purpose of settling disputes between employers and workmen, and for the furnishing by them to the Board of Trade of such returns, reports of proceedings, or other documents as may be required. Where a difference exists or is apprehended between employers and employed, the Board are also empowered to take steps with a view to an amicable settlement of the difference; and these steps may include, *inter alia*, the appointment (upon the application of either party) of a person or persons to act as Conciliator or as a Board of Conciliation, or (upon the application of both parties) the nomination of an Arbitrator. In view of the powers conferred by the Act, the annual report of the Board forms a useful summary of the progress (or otherwise) of the principle of conciliation in trade disputes for the period covered by the statistics. As is pointed out, the year 1911 was characterized by considerable industrial disturbance; the number of workpeople involved in disputes causing a stoppage of work being the highest in any year since statistics of trade disputes have been recorded by the department. To strengthen the official machinery for the settling or shortening of industrial disputes, there was established the Industrial Council, consisting of thirteen representatives of employers and a corresponding number of representatives of workpeople, with power to add to their number. Sir George Askwith was appointed Chairman of the Council, which was formed "for the purpose of considering and of inquiring into matters referred to them affecting trade disputes, and especially of taking suitable action in regard to any dispute referred to them affecting the principal trades of the country, or likely to cause disagreements involving the ancillary trades, or which the parties before or after the breaking out of a dispute are themselves unable to settle." A Chief Industrial Commissioner's Department was at the same time established, through which the existing Board of Trade powers of conciliation and arbitration are now being exercised.

Coming to the matters specially dealt with in the report under review, it may be stated that the number of cases in which action was taken under the Conciliation Act during the year 1911 was 92—a figure considerably greater than in any previous year since the Act came into force. Of these, 57 were disputes involving a stoppage of work affecting in the aggregate about 565,000 workpeople. Since 1896, 524 cases in all have been dealt with; and of these 276, or rather more than one-half, occurred during the last four years. Of the 524 cases, there were joint applications in 320; this figure including a number of instances in which application for the appointment of an arbitrator or conciliator was made by the parties as the result of negotiations conducted by officers of the department. In 114 cases application was made by the workpeople only, and in 33 by the employers only. In the remaining 57 cases, no application was made by the parties. It is pointed out that in the earlier years application for intervention came mainly from one side only (and that generally the workpeople); but of recent times there has been a tendency for a majority of the applications to be made jointly by the parties, or by organizations representing them. During 1911, the number of joint applications was 42; while in nineteen cases applications were received from the workpeople only, and in seven from employers only. Much conciliation work is, of course, accomplished without the intervention of the department; the number of Conciliation Boards in existence at the end of 1911, so far as was known to the officials, being 293, of which 277 were boards dealing with particular trades, and sixteen district and general boards, including those registered under the Conciliation Act and those not so registered. The rules of a number of these Conciliation Boards, and also other agreements arranged by employers and workpeople in various trades, frequently contain a clause providing that in the event of failure of the parties to effect a settlement of a dispute, application shall be made to the Board of Trade for the appointment of an umpire, arbitrator, or conciliator; and such clauses, so far as can be at present ascertained, now exist in 97 agreements.

The most important disputes involving a stoppage of work in which action was taken by the department during the past year were connected with the transport and cotton industries. Of those in which a stoppage of work was not involved, one of the chief was that affecting colliery enginemen in Scotland, which arose out of an application made by the men's organization for an alteration in the hours of labour. A provisional agreement between this body and that of the Associated Coalowners was reached; but it was rejected by a ballot of the men, and notices were handed in to cease work. On the invitation of Sir George Askwith, however, representatives of the parties met him in Glasgow; and, as a result of the conferences, a provisional agreement was arrived at, which was subsequently ratified—a strike which would have involved a large number of coal-miners in Scotland being thus averted.

During the year, recourse was had in seven cases to the system of Courts of Arbitration established in 1908. In each instance, the court was composed of three members—a Chairman selected from the Chairman's Panel, and two arbitrators selected respectively from the Employers' Panel and the Labour Panel. In two cases the reference to the Court was preceded by a strike; but in the others a stoppage of work was not involved.

Of the 92 cases dealt with by the department in 1911, thirteen arose in the building trades, nineteen in the metal, engineering, and shipbuilding trades, four in the mining and quarrying industries, eight in the boot and shoe trade, twenty-one in the transport trades, and nine in the textile trades. The number of cases in the metal, engineering, and shipbuilding trades was considerably above the average of previous years; and twelve of them involved a stoppage of work affecting about 10,000 workpeople.

GAS AT THE NURSING EXHIBITION.

An Attractive Show.

THE Annual Nursing Exhibition at the Royal Horticultural Hall, Westminster, is always largely attended—and by those to whose notice it is important to bring the many advantages possessed by gas in connection with the hospital and the sick-room generally. Last week saw the fifth of this series of exhibitions; and among the many stands of particular interest to the nursing profession, it can be said, from personal observation, that none appeared to receive a greater amount of attention than that of the Gaslight and Coke Company.

Situated in a position which enabled it to be seen right down one side of the hall, the Company's exhibit was appropriately arranged as a room adjoining a medical nursing ward, where coal fuel had been abolished, and where consequently there was no dust or ashes. Instead of a large assortment of gas appliances, there were merely one example of each of the special things that concerned nurses. A good feature was the engagement of a trained nurse, who was able to talk to inquirers on just the points as to which they would be most likely to require information, and who was also able to give first-rate demonstrations of tempting invalid cookery. In the first place, there was a Richmond cooker, built in a well-ventilated recess, in which the dainty dishes were prepared; and on the other side of the stand there was a Fletcher nursery gas-fire, also perfectly ventilated, and provided with a ring-burner (fixed low down at the side), on which a bronchitis-kettle was seen steaming away. Hot water was furnished by a Wilson circulator, with the flue carried into the chimney. The apparatus was fitted with a thermostat; and in connection with it there was a 15-gallon tank. A constant supply of hot and cold water was provided for a lavatory basin. A "Normandy" distiller, capable of distilling water in quantities of about 3 pints per hour—a very useful apparatus in connection with the medical profession—was also shown in operation. A Wright six-loop radiator had attached to it a new and convenient form of steam towel-drying rail. Another interesting feature was a gas sterilizing apparatus (for the sterilizing of surgical instruments, &c.), manufactured for the exhibition; and, in addition, there was on view one of the specially constructed surgical brackets, fitted with an incandescent burner and a powerful lens. The walls were covered with "Emdeca" decoration, which gave the appearance of tile-work; and on them there were five "New Inverted" burners, provided with pneumatic switches. Then, from above, the exhibit as a whole was brilliantly illuminated by four Podmore three-burner inverted lamps, each lamp giving a light of 750-candle power, and fitted with the "Telephos" attachment. The successful efforts of the nurse in inducing a proper appreciation of the advantages of gas on the part of any who did not already possess it, were seconded by some apt legends above the stand—such as "The Nurse's Friends. Gas Fires and Radiators ensure Even Temperature."

In addition to the stand of the Gaslight and Coke Company, gas was also represented in a fitted-up nursery, where there was a Richmond green enamel "Bavarian" fire, with a burner on top.

Electric Restaurant at Earl's Court.—It is reported that the Electric Supply Publicity Committee have arranged for an electric restaurant on a large scale at the forthcoming Shakespearean Exhibition at Earl's Court.

Foundry Coke for Church Heating.—The electrical papers are hard put to it to find substance with which to attack the products of gas-works. Although a vicar speaks, it is necessary sometimes that his words should be weighed, and, if upon a technical matter, a proper amount of suitable knowledge should be brought to bear upon what he says: The "Electrical Times" pounced upon a few words uttered by the Rev. Canon Nolloth, presiding over the annual vestry meeting at Beverley Minster. He expressed the hope that before long they might be able to instal electricity for lighting, and heating by hot water, and thus put an end to the deterioration now going on by the sulphur fumes from the stoves and gas. Now the association of the gas with the stoves was wrong on the part of the vicar; and "Meteor" in our contemporary apparently did not know that foundry coke was used in the stoves, and not gas coke. If he had, instead of cutting grotesque capers over the statement, he would (if he was aware of the difference between foundry and gas coke) have quietly told the vicar that perhaps all his trouble arose from the use of a coke that was never intended for the heating of a minster.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

General Meeting at Peterborough.

The Forty-Seventh General Meeting of the Association was held last Wednesday, at the Grand Hotel, Peterborough. The PRESIDENT (Mr. F. M. Paternoster, of Felixstowe), was in the chair; and there was an excellent attendance of members.

The PRESIDENT said, before starting the ordinary business of the meeting, he should like to welcome the President of the Institution of Gas Engineers (Mr. R. G. Shadbolt). He was a busy man, and yet he had attended a good many District Association meetings during the last twelve months. He (the President) was sure the members were glad that this was the second occasion on which Mr. Shadbolt had visited the Eastern Counties Association meetings during his year of office. [Applause.]

Mr. SHADBOLT thanked the members for their cordial welcome. It had been his pleasure to visit most of the meetings of the various District Associations during his year of office as President of the Institution. In this capacity, he had made a point of attending the meetings of the District Associations of which he happened to be a member, more particularly because he thought it was possible, if one neglected his own Associations, he was apt to be blamed by his colleagues, and accused of being neglectful. With regard to the meetings of the Manchester Institution and the Eastern Counties' Association, he had been duly impressed with the hearty welcomes he had received in his own homes. The District Association meetings, so far as he was personally concerned, had been of great interest; and he might honestly say, speaking in his personal capacity, that he had derived more benefit from information and suggestion received from attending these meetings than he had from attending the meetings of the larger body. The interest of the members was more fully alive in the smaller bodies than when assembled in a national body.

MINUTES OF LAST MEETING.

The HON. SECRETARY (Mr. Joseph Davis, of Gravesend) read the minutes of the meeting held at Felixstowe on Sept. 29; and they were confirmed.

REPORT AND ACCOUNTS.

The report and accounts were taken as read on the motion of Mr. H. WIMHURST (Sleaford), seconded by Mr. J. G. HAWKINS (Wisbech).

After reviewing the events of the year at the meetings of the Association, the Committee concluded their report by saying: "The year commenced with a membership of 108. The Committee much regret the death of two of their members during the year—namely, Mr. W. J. Jenkins, of Retford, who joined the Association in September, 1899, and Mr. F. Lennard, of London, who joined in the same month and year. Nine new members have been elected; the total membership at the end of the year being 115. The accounts show a balance in the hands of the Treasurer of £2 6s. 7d.; the amount received in subscriptions during the year being £57 15s. and the expenditure for the same period £55 8s. 5d. At the commencement of the year, there was a debit balance of £1 17s. 8d. The Commercial Sections have met frequently, and continue to do much useful work."

The PRESIDENT remarked that the year had been a very successful one. At the beginning of the year, they had a balance due to the Treasurer of £1 17s. 8d. They finished with a balance in hand of £2 6s. 7d. They had added a good number of names to the list of members during the year; and they had several gentlemen to elect at the present meeting. The Association was therefore in a very satisfactory position.

On the motion of Mr. J. T. JOLLIFFE (Ipswich), seconded by Mr. J. H. BREARLEY (Longwood), the report and accounts were unanimously adopted.

THE LATE MR. C. F. RUGGLES.

The PRESIDENT said he had next to refer, and he did so with profound sorrow, to the great loss the Association had suffered by the death of one of their recent Presidents. He alluded to the late Mr. C. F. Ruggles. His loss was a severe one to the Association, and a deep one to his family. As an Association, they would miss his genial presence for a long time from their meetings. He (the President) had all his life known Mr. Ruggles; and his death was therefore a great blow to him. He wished to propose that the Hon. Secretary be instructed to write a letter to Mrs. Ruggles and the family expressing their sympathy.

The motion was carried by the members silently rising.

NEW MEMBERS AND ASSOCIATES.

On the motion of Mr. J. H. TROUGHTON (Newmarket), seconded by Mr. F. L. Wimhurst (Newcastle-under-Lyme), the following names were added to the membership roll: Mr. Thomas Davis, of Horncastle; Mr. F. A. Last, of Halstead; Mr. T. Freeman, of Manningtree; Mr. John Young, jun., of Leighton Buzzard; Mr. C. F. Veevers, of Northfleet; Mr. O. F. Winpenny, of Woodhall Spa; and Mr. E. Bradford, of Leigh-on-Sea.

Proposed by Mr. A. E. BROADBERRY (Tottenham), seconded by Mr. J. G. HAWKINS (Wisbech), the following gentlemen were elected as associates: Mr. W. C. Dawson, of Nottingham; Mr. W. S. Smart, of Retford; and Mr. Thomas Glover, of Edmonton.

PAPERS AND DISCUSSIONS.

The first paper read was by Mr. R. WARDELL, of Cambridge. It was entitled "Some Notes on the Efficient Running of Gas-Engines," and, with the discussion, is published on pp. 289-93.

The second paper was by Mr. A. F. YOUNG, of Bury St. Edmund's. It was on "Holder Construction: Some Reflections and a Suggestion." The paper, with the discussion, will be found on pp. 293-95.

At the close of the discussions,

Mr. R. G. SHADBOLT (Grantham) remarked that he had to propose a cordial vote of thanks to the writers of two exceptionally good papers. The paper by Mr. Wardell was one that, so far as he was personally concerned, he should put by for reference. A great feature of the paper, to his mind, was the exact way in which Mr. Wardell had (so to speak) analyzed the different causes of inefficiency in the working of gas-engines, and had investigated them one by one. He had shown that all these causes working together would result in inefficiency; and he had given them something, too, which showed how these causes singly could bring about inefficiency. Mr. Young's paper was one of a different character. They ought to encourage individual criticism and effort of this kind. The model Mr. Young had brought before them illustrated how his idea could be effected under practical conditions, and enabled them to realize what really Mr. Young had in his mind. The thing appeared to be practicable. As to whether the remedy would be worse than the disease in some cases remained to be threshed out.

Mr. T. GLOVER (Norwich), in seconding the motion, said he thought the Association were to be congratulated upon having men in their midst able to produce two papers of such great interest. They were instructive; and they would give them cause to think not only that afternoon, but when they returned home. He regarded both contributions as being of considerable value.

The motion was cordially carried.

Mr. WARDELL said he heartily thanked the members for the kindly way in which they had received his paper. The discussion on it had been very gratifying to him. He appreciated also the feelings which prompted them to invite him, one of the youngest members of the Association, to contribute to the transactions. The aim of his paper was to draw attention to the advisability of the systematic examination of gas-engines; and, if he had succeeded in his aim, his effort had not been in vain.

Mr. YOUNG also acknowledged the vote.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT proposed that the Vice-President (Mr. T. A. Guyatt, of Ely) be elected President for the ensuing year.

Mr. SHADBOLT, in seconding, said he had been connected with the Association now for some years; and, as an old member of the Committee, he had had an opportunity of realizing the valuable services that Mr. Guyatt had rendered to the Association as Hon. Secretary in the past. He lacked none of the qualifications for a successful President of an Association such as this.

The motion was cordially carried.

Mr. GUYATT expressed his thanks for the honour conferred upon him. Having been several years the Hon. Secretary of the Association, he supposed it was thought that he had some qualification for the presidency. They had had two notable examples of the truth of this in the past; and he hoped he should be able to carry out the duties of the office in such a way that the Association would not suffer during the year.

Proposed by the PRESIDENT, and seconded by Mr. J. W. AUCHTERLONIE (Cambridge), Mr. T. Goulden, the Chief Engineer of the Gaslight and Coke Company, was cordially elected to the office of Vice-President.

Moved by Mr. J. H. BREARLEY (Longwood), and seconded by Mr. J. B. FENWICK (Retford), Mr. C. G. Grimwood, of Sudbury, and Mr. J. Hawksley, of Lowestoft, were appointed members of the Committee.

On the proposition of Mr. H. WIMHURST (Sleaford), seconded by Mr. J. H. TROUGHTON (Newmarket), Mr. Joseph Davis was unanimously re-appointed Hon. Secretary and Treasurer.

Mr. DAVIS having thanked the members,

The Auditors (Messrs. W. Beale and J. Brown) were re-elected.

PLACE OF NEXT MEETING.

On the motion of the PRESIDENT-ELECT, seconded by Mr. JOHN BARTON (Peterborough), it was decided to hold the autumn meeting at Ely.

Mr. JOHN CARTER (Lincoln) moved a cordial vote of thanks to the President and officers of the Association for the services they had rendered during the past year. Their President was probably the youngest member of the Association to occupy the chair; but he had carried out his duties in such a way as to fully maintain the traditions of the office. All their officers had likewise worked with the greatest cordiality during the year.

Mr. A. E. BROADBERRY seconded the motion, and it was heartily passed.

The PRESIDENT briefly but cordially replied on behalf of himself and the officers generally.

ELECTRICITY SUPPLY MEMORANDA.

The Second Turn—The Liverpool Failure—E ectric Water-Heating—On Insults to Intelligence—Cookery Check Test by a Converted Lady—Meat-Saving—Electrical Neglect of All Else but Baking—Desperation—Immaculate Marylebone—Only a Spark.

THE members of the Institution of Electrical Engineers have had their second solemn turn at the subject of domestic electrification for purposes other than lighting. Speech after speech fell, each dealing with some point in the old, old story. There was nothing new—no sparkling suggestion came to relieve the dreary waste of many words. Originality seems to be asleep for a time in the electrical industry. One difficulty in the situation was neglected; it always is in public discussions by electricians. No one pointed out that what electricians are trying to do is to make electricity fit purposes of heating for which it has not been so richly endowed as its competitors. Mr. Seabrook got close to the subject when he said that coke and coal are cheaper than electricity for continuous heating. He might without being accused of departing from the path of integrity, have added to coke and coal the gaseous extract of the latter. However, without making any special recognition of the bottom place of electricity in heating power, the speakers followed the conventional lines in distributing blame for the backwardness of the industry in ministering to the domestic requirement for heat. Municipal domination was accused of being a drag. Electrical station engineers were blamed for allowing their station up-bringing to bear too much upon their commercial relations with the public. The electrical contractors were charged with being obstacles; and they were asked to repent, and to commit the penitential act of burning their fingers by letting out on hire cooking and other apparatus. Want of enthusiasm is yet another assigned cause.

However, the cooking question had a little prominence. One speaker suggested that it is necessary that a good electric cooking-stove and accessories should be supplied cheaply; and that, if there was a loss, it should be covered by an increase in the price charged for current. He regarded the present policy of cutting-down the cost of the apparatus at the expense of the life as a mistaken one. That was very sensible on his part. A further speaker also declared that much of the electrical cooking apparatus on the market is unreliable. Once more some electricians indicated how illogical they are. The first-water virtues that electricity possesses for all heating purposes were spoken of, and then, in the same breath, there was talk of the low prices at which the current must be supplied for the purposes—prices that some station engineers would not think of supplying at for power purposes with such intermittent loads as cooking. Mr. Seabrook tried to infuse a little enthusiasm by giving vent to a few top notes. He stated that some 4000 persons were served at the Electricity Restaurant at the recent Smoke Abatement Exhibition; and the current consumed for cooking, lighting, heating, and auxiliary purposes was 3600 units. He does not tell us what those 4000 persons were served with. On the various occasions that a visit was paid to the restaurant, most of the persons present had dainty pots of tea in front of them. As every person who depends upon the electricity industry for bread and butter who went to the exhibition must out of loyalty have visited the electrical restaurant, the 4000 servings do not constitute anything very remarkable. Some of the Institution members looked at one another and smiled. Then there was a smashing blow for the unbelieving and unenthusiastic. In the district of the Marylebone Borough Council, it was said, "hundreds" of electric cookers are in use. Probably there was a slight mistake over an "s" being suspended to the tail of the hundred. Beyond this, there was not very much heard of cooking; but cooking current is being offered at a very low price, and so has some connection with a point made by Mr. W. M. Mordey—the gentleman who was recently suggesting that the illuminant a man uses would be a good indication of his riches or his poverty. He commented on the fact that the output of electricity per head of the population is increasing and the cost decreasing. But he did not say in which direction the increase of output is trending. It has been mainly in the direction of power purposes at such low prices that naturally the average per unit is diminishing—this being a condition of things that is causing no little consternation in some quarters. In 1911, the average price in West Ham had dropped to under 1d. per unit. In that year, the gross revenue was £20,781 more than in 1909; but the net profit was only £133 more!

The recent failure of the electricity supply at Liverpool, as reported last week in our news columns, will carry additional lessons not only to the citizens, but it is hoped to many others beyond the city bounds. In this instance, previous experience—that gained during the strike last summer—lessened considerably the gravity of the occurrence, because since then numerous tradesmen have re-established trustworthy gas, and can therefore have recourse to either supply according to desire. But we insist, and shall continue to insist, that these repeated failures of electricity supply emphasize the importance of local authorities obtaining power to order that, where the public assemble, or where for any purpose anything of grave importance is proceeding—such as operations at hospitals—there shall be provision for immediate recourse to an alternative system of lighting. We remember the great collapse at Glasgow, when public institutions and railway stations were plunged in darkness. At Liverpool, a goodly proportion of the places of public entertainment have their own gas-driven generating plants; and the managers of such places warmly congratulated themselves upon their good fortune when extinction caused the collapse of performances in other places. There are quarters where, on humane grounds alone, there should not be absolute dependence on such an uncertainty as electricity for lighting purposes. The failure of the light, stated one local newspaper, proved very trying to the public hospitals; and it transpires that two operations were proceeding at the time of the failure. The public voice ought to protest against the single use of such an unreliable agent where life and death issues are involved. This is not the first time failure has occurred during operations. In one of these Liverpool instances, a small gas-stove came to relieve the situation through the presence of mind of someone suggesting the stopping-up of the air-holes of a small gas-fire, and so producing a luminous flame.

Our electrical friends are constantly wrestling with the hot-water problem; but they cannot get away from the fantastic notions they possess as to what people will suffer in the way of waste of time and money, and in putting up with an amount of inconvenience that tolerated would be a very fair guarantee of mental derangement. The intelligence is published by the "Electrical Times" that the only stronghold left to gas now is water heating; all the others have apparently been captured. Water heating by gas must have had a remarkable boom, the dimensions of which we had manifestly not properly measured—seeing that the revenue of the gas industry last year was greater than the year before. It is strange what big events take place in the industry, news of which only reaches us through the electrical press. The article in our contemporary speaks of the "Therol" heater, which *paterfamilias* looks upon as a huge and expensive electrical joke. However, the "Electrical Times" has kindly and depreciating words to say of it in the same breath. The makers do not recommend it as a substitute for the kitchen boiler for maintaining a circulating system throughout the house. Its "high efficiency" depends upon the storage of heat electrically produced in an insulated iron casing, through which cold water passes when required and is heated in the process. If the "Therol" heater were to deliver hot water to taps throughout the house, its efficiency would suffer materially from the long runs of unlagged pipework. But now there is the Belenus electric boiler, which is to replace, or else work in conjunction with, the ordinary kitchen boiler. There is no information about installation expenses. As to the running, the hourly consumption of current can be varied from 28 watts to 9 kilowatts. As a general rule, this electric boiler would be run at 500 watts on a 24-hour load factor. Uniformly maintained at this, the consumption would mean 12 units a day, or 4380 units a year. Supposing a person wanted a bath quickly, then the boiler would be run full-on at the rate of 9 kilowatts an hour; and "sufficient" for a bath would be obtained in twenty minutes—thus the heating of the water for a single bath (the quantity and temperature are judiciously not stated by our contemporary) would cost 3d. A few baths in a house at this price per day with a constant loading in between would constitute a useful subscriber of revenue to an electricity undertaking.

Our old friend, Mr. Grogan, the "Tricity" cooker lecturer, has found time to write a letter to the "Sussex Daily News" with reference to the Brighton and Hove Gas Company's tests with an electric and gas cooker run under comparable conditions. The publication of the tests excited Mr. Grogan to such a degree that he must needs, on the very first night of his arrival in Brighton to deliver a series of cookery lectures, with demonstrations, sit down and write to the local paper a letter as thin as any it has been our lot to see on this particular subject. Mr. Grogan does an injustice to that magnanimous characteristic of his which gives the public the credit of having a large swallowing capacity when he describes as fiction test results that bear the attestation of three persons who are better known in Brighton for their integrity than is Mr. Grogan. The "fiction," he says, was exposed in the "Electrician" and "Electrical Industries;" but strange we have not seen anything in the nature of an "exposure" in either of these papers, unless Mr. Grogan refers to the publication of certain unconscious confessions of ignorance that we have perused. He wonders that the contributor of the "Sussex Daily News" has had the audacity to reprint the figures; and he expresses his opinion (we are glad that he owns to it being the conception of his own mind) that such action is an insult to the intelligence of the Brighton public. Irate Mr. Grogan!

It will be interesting to see whether the letter by Mr. Grogan is not an insult to the intelligence of the Brighton public. He deals superficially, and in a manner calculated to mislead the public, with No. 1 test, quoted in our article in the "JOURNAL" for the 2nd inst. He says he has had a check test taken by a lady who has only recently been converted from gas to electric cooking. The "check" test was only made in a "Tricity" cooker; there was no "check" test in a gas-oven. The figures and information as to the electric-oven test are not published so fully as in the Brighton tests. The converted lady (we are not told who she is), our evangelical friend states, took 3 lbs. 7 oz. of sirloin of beef, the same as in the No. 1 test with the "Tricity" cooker test in the Brighton experiments. The baking of this occupied 1 hr. 30 min., including twenty minutes to pre-heat the oven; and the cost was slightly under 2d. Now Mr. Grogan does not tell us what was the price per unit; but we will assume it is 1d. Therefore, the temperature of the oven would be about the same as in the case of the electric-oven in the Brighton tests. The joint was in the

oven in the latter case a quarter of an hour longer than in the test by the converted lady; yet in the Brighton case the "joint was not quite cooked." What must have been the condition of the joint in the "check" test. Naturally, the less a joint is cooked, the less the evaporation; and therefore Mr. Grogan gives his word that the joint when cooked weighed 3 lbs. 1 oz. This seems very good proof that the joint was not well done, as the best of cookery experts tell us that there must be a loss of from 2 to 3 oz. per lb. if a joint is cooked in the way that it should be, and the consumers be delivered from all evil. A lady demonstrator in the Electricity Department of the recent Smoke Abatement Exhibition told the writer personally that, in electric cooking, she preferred half an hour for heating-up the oven, and then to allow twenty minutes for each pound of meat, and twenty minutes beyond to ensure thorough cooking.

The virtuous Mr. Grogan then proceeds to make a point in a manner that is not worthy one of the champions of even a commercial cause. He wrote: "In the gas-cooked joint *of the same weight* (?) the result, when cooked, weighed *2 lbs. 8 oz.* Hence, with gas, there is an extra loss in the cooking of 9 oz. of beef, worth at least 6d.—if the figures you give are a statement of fact." It was not until after he had made the point that his conscience smote him; and he confessed that the joint used in the Brighton gas-oven test weighed at the start only 3 lbs. 4 oz. and not 3 lbs. 7 oz.; and therefore he condescends to make an allowance of 3 oz. for the gas joint. Now what does he do? He finds that the well-cooked gas joint of the Brighton test weighed 6 oz. less than the "Tricity" joint treated by the converted lady to a period a quarter of an hour less than the joint in the Brighton electric-oven test, which joint was then not well cooked. He expects the intelligence of the Brighton public to accept this sort of thing. We wonder what Brightonians think of the intelligence of Mr. Grogan in assessing their intelligence so lightly and their credulity so heavily. He regards the difference obtained by the retention, by lessened cooking by electricity, of more of the vaporizable content of the meat as worth the same money as the solid, and so takes credit for 4d. Therefore the householder out of the saving pays his 2d. for the electricity consumed, and has 2d. in his pocket to the good. It is all so simple—so simple that Mr. Grogan cannot disguise its outstanding characteristic.

The critic next says that too much electricity was consumed in test No. 2. He is right. Mr. Cash has had the test repeated; and, as the result, he frankly admits that the quantity of current used should have been 1·7 units, and not 2·7 units. Mr. Cash apologizes for the error. The result, however, leaves the question of cost in this test still in favour of gas. The corrected figures are:

No. 2 Test.	"Tricity" Cooker.	Gas-Cooker.	Difference.
Consumption . . .	1·7 units ..	24 cub. ft. ..	—
Cost	1·7d. ..	0·81d. ..	0·89d.

The other figures stand unchallenged; but Mr. Grogan thinks because this single error has been discovered, it is "unnecessary to go into the details of the remaining figures, which include such unreliable information." Perhaps he will tell us which "remaining figures include such unreliable information." It is not brave to allege unreliability in the remaining figures without pointing it out. He does not refer to any of the boiling operations, which also must be taken into account (and largely) in connection with cooking. He sticks to baking with the same tenacity as a man in peril of drowning would to a lifebelt. We detect in Mr. Grogan's attitude a strong dislike to the gas industry taking up the analysis of the fallacies that the electric-cooking advocates are trying to promulgate. "All this gas-inspired talk," he remarks, "about electrically cooked food being uncooked and pale, and taking an unconscionable time in the process, is nothing but the desperate attempt of a frightened industry to stop the progress of a formidable rival." All the "desperate attempt" appears to be on the side of the electrical cooker folks, who show their desperation by essaying to gain ground by the queer method of endeavouring to juggle with the public, and by omitting to publicly talk much of matters that should come into the reckoning—not of baking in particular, but of cooking in general. It is a pity that Mr. Grogan, while in Brighton, did not (so far as we are aware) act on the suggestion made in the "Memoranda" last week—that is, witness work done by Miss Weston with the two stoves—electric and gas, and sign the tests on behalf of the Berry Construction Company, for circulation broadcast throughout the country.

The Electricity Committee of the Marylebone Borough Council have published a report in defence of the Sales Department, which the local electrical contractors assert is so inimical to their business. The report is a pretty piece of special pleading; and the less said about its composition and texture the better. We should think the local contractors will be able to deal with it as destructively as they sometimes do with wire-drawn filaments of another order. There is one striking passage in the report: "We never reduce a price after quoting, unless, of course, the customer reduces the order." Is this really so? If it is not, then someone ought to see that the public gets the truth, the whole truth, and nothing but the truth. Is it possible that the department has on no single occasion made such a slip as reducing a quotation in larger proportion than a customer lessened his requirements?

There was a big fire at the factory of the Columbia Phonograph Company, at Wandsworth, last Saturday week. The loss of valuable machinery and materials, it is reported, will run into many thousands of pounds. What was the cause? Simply an electric spark coming in contact with some shellac in a room where mixing and grinding processes are carried on.

A GAS EXHIBITION FOR EDINBURGH.

The announcement has already been made in "Notes from Scotland" that it is the intention of the Edinburgh and Leith Corporations' Gas Commissioners to organize an exhibition of gas appliances, which is to take place in the Waverley Market, Edinburgh, from Oct. 22 to Nov. 2 next. This will be the first exhibition of the kind which has ever been held in Edinburgh; and the Gas Commissioners are sparing no effort to make it a huge success.

A copy of the prospectus has been forwarded by the Exhibition Manager (Mr. James M. Freer); and in this there is a statement by Mr. Alexander Masterton (the Gas Engineer and Manager), who points out that there will be on show specimens of all the most up-to-date appliances for efficiently and economically using gas for lighting, heating, cooking, power, and other domestic and industrial purposes. The whole project will be designed with the object of interesting the public in these matters, and of bringing before them, in a practical form, the advantages to be gained, and the economies to be effected, by adapting for everyday use the recent scientific discoveries; and it is felt that the time is fully ripe for this purpose, and that there is a wide field for business. The lighting of the building and the outside surroundings will be carried out on the high and low pressure system. The building chosen for the display (a large and spacious structure, suitably designed for the purpose in view) is centrally situated at the east end of Princes Street. It can be easily and quickly reached by tramcar from every district in the city, and is in close proximity to both the North British and Caledonian Railway Stations.

The gas required by exhibitors will be supplied, to a reasonable amount, free of charge; and the piping for supplying it will be laid by the Commissioners close up to the various stands.

The charge for space will be 2s. 6d. per square foot of area; and 50 per cent. of any profits which may be derived from the exhibition will be divided among the exhibitors *pro rata*. In connection with the display, there will be lectures, demonstrations, and competitions. Plans and details, with conditions of exhibition, may be obtained from Mr. Freer, at No. 15, Calton Hill, Edinburgh.

ASSOCIATION OF GAS AND WATER ENGINEERS OF AUSTRIA-HUNGARY.

Forthcoming General Meeting.

It is announced that the thirty-first general meeting of this Association will be held at Agram on the 16th to the 19th prox., under the presidency of Dr. Franz Heltai, of Budapest. There will be an inaugural reception on the evening of Thursday, the 16th prox., and on the Friday morning, the President will deliver his address, to be followed by the reading of technical communications, which will be concluded on the Saturday morning. On Friday afternoon, the Agram Gas-Works will be visited; and on Saturday afternoon the water-works. On Saturday evening members will attend a short performance at the theatre, and a banquet at nine o'clock. An excursion has been arranged for the following day. The papers already announced for reading include: "A Description of the New Gas-Works at Agram," by the Manager, Herr M. Schönstein; "How to Increase the Duty Obtainable from Illuminating Gas," by Herr Jonas, of Berlin; "Heating with Producer Gas from Low-Grade Fuel," by Herr Julius Pintsch, of Vienna; "Practical Hints on Overcoming Structural Difficulties in Water Distribution," by Herr F. Holuschka, of Vienna; and "The Action of High-Tension Electric Currents on Gas and Water Mains," by Herr Johann Rautenkrantz, of Vienna. The full list of papers has not, however, yet been issued. A gas exhibition will be held in connection with the meeting. An eight days organized tour through Bosnia, Herzegovina, and Dalmatia is being arranged—starting on the 19th prox.; and it is hoped that all who attend the meeting will be able to participate in this tour, which will finish at Vienna on May 27.

Three-Storey Water-Tank.—A reinforced concrete water-tank having three storeys has recently been built at the Chicago Junction, Ohio, for the Baltimore and Ohio Railroad Company. The actual tank is 30 ft. 6 in. deep, with an inside diameter of 24 feet; and it has a storage capacity of 100,000 gallons. It occupies the top section of the structure, while the lower section is used as a pump-room and the middle one for storage purposes. The bottom of the tank is 50 feet above the base of the rail; while the extreme height over all, from the bottom of the concrete base to the top of the tank, is 93 ft. 6 in. The tank is supplied by electric power pumps operated automatically by means of a float-valve which makes or breaks the electric connection. The concrete in the base is a 1:3:5 mixture; the rest of the structure up to the tank bottom is a 1:2:4 mixture; while that in the tank proper is richer and differently proportioned, with a certain amount of hydrated lime in it to waterproof the mass. The tank was finished and put into service on the 2nd of January last; and it is stated to have stood successfully a very severe test of freezing.

TAPLAY'S COMBUSTION GAS ANALYSER.

AN APPARATUS FOR GAS ANALYSIS BY COMBUSTION OVER COPPER OXIDE.

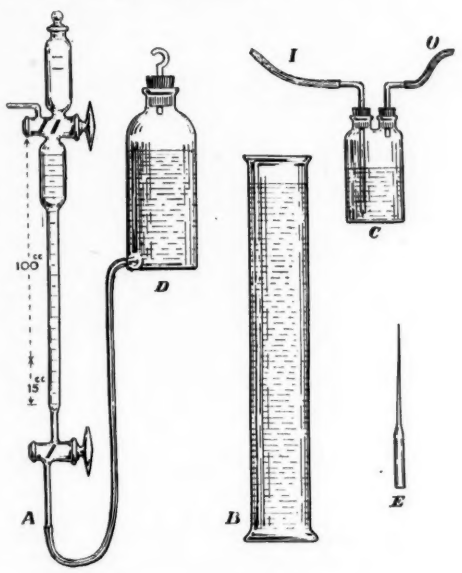
Described with Useful Notes and Instructions.*

By J. G. Taplay.

(*Concluded from p.* 219.)

The Bunte Gas-Burette.

The absorbable constituents of a gaseous mixture can, as already stated, be ascertained in an Orsat, Hempel, or other apparatus. The writer's preference is for a Bunte burette; and he therefore ventures to append the following description of the method he employs in manipulating it.



A is the gas-burette, graduated to 115 c.c., in fifths of a cubic centimetre. It is made as conveniently short as possible by having a bulb blown at its upper end, above which is a two-way tap carrying a capillary inlet tube and a cup which can be closed by a glass stopper. At its lower end is another tap, and below this is a capillary jet. B is a cylinder to hold water for cooling the burette and enclosed gas, and sufficiently tall to enable the whole of the burette, except the upper tap, to be immersed in the water. C is a suction-bottle containing a little water made alkaline by caustic potash solution, and employed to withdraw liquid from the burette to enable the absorption reagent to enter. If a water-pump is provided in the laboratory, this suction-bottle is not needed. D is a pressure-bottle containing water saturated with gas similar to that which is to be analysed. It is employed for washing the interior of the burette previous to reading the volume of the remaining gas after the absorption of each constituent. A length of rubber tubing is connected on to the tubulure of the bottle. Near the other end of the rubber tubing is a pinch-clip. E is a piece of glass tube about ⅛ inch internal diameter at the larger end, and at the other end drawn out small enough to enter the capillary of the jet below the tap at the lower end of the burette. It is employed to fill this jet with water after the sample of gas has been enclosed in the burette.

Constituents to be Absorbed.

The following is a list of the constituents of an illuminating gas mixture which are determined by absorption, together with the reagents employed and the order in which they are absorbed when using the Bunte burette for the purpose.

1—*Carbon Dioxide* (CO_2).—Absorbed by means of a solution of potassium hydroxide (caustic potash).

2—*Hydrocarbons of the Olefine Series* (ethylene, C_2H_4; propylene, C_3H_6; and small quantities of other hydrocarbons, not paraffins, classed together under the general formula C_nH_{in}).—Absorbed by means of a dilute solution of bromine.

3—*Benzene Vapour* (C_6H_6).—Absorbed by means of a strong solution of bromine in potassium bromide.

4—*Oxygen* (O_2).—Absorbed by means of a solution of pyrogallic acid, made strongly alkaline by caustic potash.

5—*Carbon Monoxide* (CO).—Absorbed by means of an acid solution of cuprous chloride.

The residual gases, consisting of hydrogen (H_2), methane (CH_4), and nitrogen (N_2), are determined by combustion over heated black copper oxide (cupric oxide), which process has been already described.

The Absorption Reagents.

A few particulars about the reagents themselves are given below:

1—*Solution of Potassium Hydroxide* (*Caustic Potash*).—Two pounds (1000 gms.) of stick caustic potash, not purified by alcohol, are dissolved in one pint (560 cc.) of water to make the stock solution. When required for the absorption of carbon dioxide, a small quantity of this solution is diluted with three times its volume of water, and the resulting dilute solution is employed in the burette.

2—*Solution of Bromine* (*Bromine Water*).—A saturated solution of bromine in water forms the stock solution. When it is required for use, one volume of the strong solution should be diluted with four times its volume of water.

3—*Solution of Bromine in Potassium Bromide.*—This is a very strong solution of bromine; but inasmuch as the requisite strength cannot be obtained by merely dissolving bromine in water, potassium bromide is added, by which means considerably more bromine can be dissolved, and at the same time the vapour tension due to the bromine is kept low. The solution can be prepared by mixing a pint (560 cc.) of water, ½ lb. of potassium bromide, and 4 oz. avoir. (115 gms.) of bromine together. After use in the burette, most of this reagent can be removed, in the manner described later on, and returned to the stock bottle for further use.

4—*Solution of Pyrogallic Acid.*—To ¼ pint (140 cc.) of water add 50 grains (3·25 gms.)—10 grains of salt to an ounce of water—of crystallized pyrogallic acid. When required for use, about 1 c.c. of this solution is drawn into the burette, followed by an excess (6 to 7 c.c.) of the strong solution of potassium hydroxide. An excess of the latter reagent is added to prevent the formation of carbon monoxide. The two reagents should not be kept together in the stock bottle.

5—*Acid Solution of Cuprous Chloride.*—To a pint (560 cc.) of strong hydrochloric acid add 4 oz. avoir. (115 gms.) of cuprous chloride powder, and place in a stoppered bottle, the stopper of which is greased. Some spirals of metallic copper, or several lengths of copper wire, are now placed in the bottle, so as to reach from the bottom to the surface of the liquid. The solution will at first be nearly black in colour, and contains cupric chloride; but afterwards, in the absence of air, it will become colourless and clear—the metallic copper having reduced the solution to the cuprous state. This colourless solution is used undiluted in the burette.

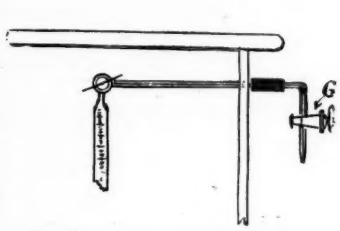
If only occasional analyses are to be made, two bottles for the solution are required—one containing the very active cuprous chloride, which, after use in the burette, is transferred to the second bottle. But if analyses are to be made frequently, it will be found convenient to employ three bottles. The first bottle contains the fresh solution, the second one the solution which has been transferred from the first bottle and used in the burette, the third one is filled with the solution which is undergoing reduction to the cuprous state. Working in this manner, it will be found necessary to occasionally oxidize the cuprous chloride, because in time it becomes slow in its action, owing to the quantity of carbon monoxide it has absorbed. This is accomplished by simply leaving the stopper out of the neck of the bottle and occasionally shaking the liquid—thus exposing it to the action of the air. The liquid absorbs oxygen and becomes black in colour, and contains cupric chloride. At the same time the carbon monoxide is slowly discharged into the atmosphere. In a few days' time, the stopper may be replaced, and the solution reduced to the cuprous state. It is then ready for use.

It should be understood that a colourless solution gives no guarantee as to its activity towards carbon monoxide.

The metallic copper should be kept in each bottle containing the acid solution of copper chloride.

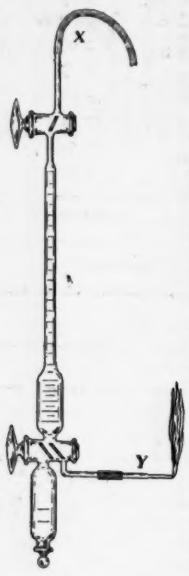
After use in the burette, a large proportion of the reagent can be removed and returned to the stock bottle for further use.

*In regard to the first part of Mr. Tapley's article published last week, it may have been observed that, while the tap G is repeatedly mentioned in the text, it is non-existent in the sketch on p. 217. It should be on the right-hand outlet from the burette A, instead of the short piece of rubber tube shown at the top right-hand side of the sketch.—Ed. J.G.L.



The Analysis of the Gas.

Manipulation of the Bunte Burette.—The burette A used for the collection of the sample of gas should be dry. It may be supported by means of a clip fixed at one end of the wooden case containing the combustion analyser. The supply of (say) illuminating gas is connected by a rubber tube at X, and a small piece of rubber tube, carrying a glass tube acting as a burner, is fixed at Y. Ten minutes will be sufficient to drive all the air out of the burette. The sample of gas is then enclosed by first shutting off the outlet tap and then the inlet tap.



It may be mentioned that if the sample of gas is too small to admit of its collection in the burette in the manner previously described, the difficulty may be overcome by filling the burette with mercury, by means of a reservoir connected to the lower jet of the burette by thick-walled rubber tubing, then connecting the gas supply to the upper capillary and allowing the mercury to flow out of the lower jet.

Original Volume.—Remove the rubber tube and the glass gas-burner from the burette, and the latter from the clip, and fill the jet at the lower end of the burette with water by means of the drawn-out glass tube E. Connect this jet to the pressure bottle D, by means of the rubber tubing, taking care that the latter is quite full of water. The pressure bottle is, of course, at a higher level than the burette. Open the lower tap of the burette and the pinch-clip on the rubber tube, and allow water to slowly flow into the burette until it is just above the lowest graduation. The gas in the burette is now under slight pressure. Fill the cup on the top of the burette with water to just above one of the two marks—it does not matter which mark is chosen, so long as the same mark is employed each time. Place the burette and enclosed gas in the cooling tank B, filled with water, and allow it to remain for two or three minutes. Now open the top tap and allow the gas under pressure to escape through the water in the cup. When it has ceased to flow, close the tap and remove the burette from the tank, fix it in the clip, and read the volume of gas. Let it be assumed that the volume is 114·8 c.c.

Carbon Dioxide.—Connect the suction-bottle C to the jet of the burette by means of the thick-walled rubber tube I and apply the mouth to the other thick-walled rubber tube O, and, with the lower tap of the burette open, withdraw the enclosed water from the burette until it is just above the tap, which is then at once closed. Remove the suction-bottle and immerse the jet of the burette in a basin containing some of the dilute solution of caustic potash, open the tap and allow the reagent to flow in the burette, and when the flow has stopped close the tap. Hold the burette in a horizontal position and rotate it two or three times so as to wet the whole of the interior, then allow the burette to lie in the horizontal position two or three minutes. This procedure will absorb any carbon dioxide present in the gas mixture. The burette is now held in the vertical position, and the potash solution is washed out—this being necessary because the original volume of gas was measured saturated with water vapour; and as solutions of caustic potash of varying strengths absorb water vapour in varying proportions, the tension due to the latter must be restored before reading the volume of remaining gas.

Fill the cup with water, open the top tap, and allow the water to flow down the sides of the burette. When the water has nearly ceased flowing into the burette, open the lower tap and allow the liquid to run into a beaker or other convenient vessel. One cupful of water should be sufficient for this washing. Now close the lower tap, and then the upper one as soon as the flow of water has ceased, fill the cup with water up to the chosen mark, and immerse the burette in the cooling tank for two or three minutes, then open the top tap and allow water to flow into the burette from the cup. When the flow has ceased, close the tap and remove the burette from the tank. Probably a little water will "hang up" in the neck of the burette just below the top tap. This should be shaken down. Next place the burette in the clip and allow it to remain for two minutes, then read the volume of the remaining gas. Let it be assumed that the volume is now 112·6 c.c. Then the volume of carbon dioxide absorbed is 2·2 c.c., and the percentage volume is 1·92.

Hydrocarbons (C_nH_m Group).—Remove water from the burette in the manner previously described, introduce some dilute bromine water, and close the lower tap. Hold the burette horizontally and shake the liquid with the gas; and when the orange colour of the liquid has changed to a lemon colour, remove the liquid by means of the suction-bottle and introduce some fresh bromine solution. Again shake for a few minutes, then remove the liquid and introduce some caustic potash solution, and shake in order to remove bromine vapours. The potash is now washed out with water as before, and the burette and contents cooled, removed from the cooling tank, and the volume of gas observed. Suppose the volume now is 108·0 c.c., then the volume of these hydrocarbons absorbed is 4·6 c.c., and the percentage volume is 4·0.

Benzene.—The water is removed from the burette, and some of the strong solution of bromine in potassium bromide is introduced. The contents of the burette are shaken for a few minutes with a period of two or three minutes for rest, then shaken again, followed by another period of rest. This is repeated for about fifteen minutes if the volume of benzene does not exceed about 1 per cent.; but if the volume is about 0·2 to 0·5 per cent., half this time will be ample. The liquid can now be removed from the burette and returned to the stock bottle. Fill the cup with water and open the top tap, allowing the water to flow in (this is quite easily done, as the tension of the bromine is low, owing to the presence of the potassium bromide). Then partly open the bottom tap, and the bromine liquid with the water on its surface will flow out of the burette. When the former has been removed, first close the lower tap and then the upper one. Withdraw the water by means of the suction bottle, introduce some caustic potash solution, remove bromine by shaking, wash out the potash by means of water, cool the burette and contents, then read the volume of the remaining gas. The volume now reads (say) 107·6 c.c. Then the volume of benzene absorbed is 0·4 c.c., and the percentage volume is 0·35.

Oxygen.—The water is again removed from the burette, and a little of the solution of pyrogallic acid is introduced, followed by an excess of the strong solution of caustic potash. The burette is held horizontally, rotated two or three times to thoroughly mix the solutions, and the former allowed to lie in the same position for a few minutes. The liquid is now washed out with water, the burette cooled, and the volume of remaining gas again observed. Suppose the observed volume is 106·8 c.c., then the volume of oxygen absorbed is 0·8 c.c., and the percentage volume is 0·7.

Carbon Monoxide.—The water is once more removed from the burette, and some of the acid cuprous chloride admitted, and a few shakes are given. A large proportion of the carbon monoxide is at once absorbed, leaving room for the introduction of more of the cuprous chloride solution. A few more shakes are given, and then the cuprous chloride is removed from the burette. To accomplish this, fill the cup of the burette with water which has been acidified with hydrochloric acid in the proportion of about eight parts of water to one part of acid. Now proceed to remove the cuprous chloride from the burette in a similar manner to that employed in removing the strong solution of bromine in potassium bromide from the burette. The acidified water does not precipitate the solid cuprous chloride from the solution, which would be the case if water alone was employed. The solution so removed is placed in a second bottle for the purpose. Withdraw the acidified water from the burette by means of the suction-bottle, admit a fresh quantity of cuprous chloride solution, and give the burette a few shakes—making room for a further small quantity of the reagent, which is admitted. Then occasionally shake the burette during five minutes, remove the cuprous chloride in the manner described above, again withdraw the acidified water, admit some caustic potash solution to remove the vapour of hydrochloric acid, wash out the potash with water, cool the burette and contents, and observe the volume of remaining gas. Assume the volume read is 94·1 c.c., the volume of carbon monoxide absorbed is 12·7 c.c., and the percentage volume is 11·06.

Note: On the completion of the analysis, the interior of the burette should be washed with a 5 per cent. solution of sulphuric acid, followed by a little water, and then supported in a vertical position to drain.

We have now obtained the following data:

Original volume	114·8 c.c.
Residual volume	94·1 c.c.
Residual volume, per cent.	81 97
Absorptions—	
Carbon dioxide, ,,	1·92
Olefines, &c., ,,	4·00
Benzene, ,,	0·35
Oxygen, ,,	0·70
Carbon monoxide, ,,	11·06
Total	100·00

The residual gas, consisting of hydrogen, methane, and nitrogen, is now ready to be transferred to the combustion apparatus.

Example of Complete Analysis with Figures.

The combustion of the residual gas being completed, we have obtained (say) the following results:

	c.c.
Volume of gas taken for combustion	40·60
Volume after combustion at low red heat	19·00
Contraction (hydrogen)	21·60

Then, $\frac{21{\cdot}60 \times 81{\cdot}97}{40{\cdot}6} = 43{\cdot}61$, volume per cent. of hydrogen.

{Volume of nitrogen, after combustion of methane at a bright red heat} 4·20 c.c.

Then, $\frac{4{\cdot}2 \times 81{\cdot}97}{40{\cdot}6} = 8{\cdot}48$, volume per cent. of nitrogen.

And, $\{\text{total residual gas } 81{\cdot}97\} - \{\text{Hydrogen } 43{\cdot}61 + \text{Nitrogen } 8{\cdot}48\} = \{29{\cdot}88$ volume per cent. of methane.

The combustion of the original gas for the determination of

carbon density of the olefines having also been completed, we can now calculate this carbon density as follows:

	C.C.
Volume of gas taken for combustion (say) .	42·15
Volume after combustion at a bright red heat	27·00

The percentage volume of remaining gas will be

$$\frac{27{\cdot}0 \times 100}{42{\cdot}15} = 64{\cdot}06.$$

$$\text{Then, } 64{\cdot}06 - \{CO_2\ 1{\cdot}92 + C_2H_6\ 6(0{\cdot}35) + CO\ 11{\cdot}06 + CH_4\ 29{\cdot}88 + N_2\ 8{\cdot}48\} = 10{\cdot}62.$$

This 10·62 represents the volume per cent. of carbon dioxide produced from the combustion of 4 per cent. of mixed olefines (C_nH_m). The average composition of these mixed olefines is therefore $\frac{10{\cdot}62}{4{\cdot}0} = C2{\cdot}65$.

Here, $C_nH_m = C2{\cdot}65H5{\cdot}30$.

We have now the complete data necessary for calculating the heating value per cubic foot of this sample of gas, in the following manner:

Constituents.	—	Volume. Per Cent.	Multiply by Factor 100.	Gross B.Th.U.	Multiply by Factor 100.	Net B.Th.U
Carbon dioxide .	CO_2	1·92	..	..	..	..
Olefines . . .	$C2{\cdot}65H5{\cdot}30$	4·00	2114	84·6	1973	78·9
Benzene . . .	C_6H_6	0·35	3708	13·0	3548	12·4
Oxygen . . .	O_2	0·70	..	..	..	..
Carbon monoxide	CO	11·06	325	35·9	325	35·9
Hydrogen . . .	H_2	43·61	329·5	143·7	276	120·4
Methane . . .	CH_4	29 88	1018	304·2	911·5	272·4
Nitrogen . . .	N_2	8·48	..	..	..	..
Total . . .	..	100·00	Total	581·4	Total	520·0

The factors for the olefines (2114 gross and 1973 net) are obtained in the following manner:

Heating value of propylene,	2378 (gross) and	2218·5 (net)
„ „ „ ethylene,	1624 „	„ 1517·5 „
Difference	754 „	„ 701·0 „

Average composition of the olefines, $C2{\cdot}65H5{\cdot}30$.

Then, 1624 + (754 × 0·65) = 2114 (gross) for olefines,
And 1517·5 + (701 × 0·65) = 1973 (net) „ „

TABLE *of Heat Values in Calories and British Thermal Units per Cubic Foot of the Different Gases.*

Gas.	—	Calories.		B.Th.U.	
		Gross.	Net.	Gross.	Net.
Hydrogen	H_2	83·0	69·6	329·5	276 0
Carbon monoxide	CO	81·9	81·9	325·0	325·0
Methane	CH_4	256·5	229·7	1018·0	911·5
Ethane	C_2H_6	446·8	406·6	1773·0	1613·5
Propane	C_3H_8	634·8	581·5	2519·0	2307·5
Ethylene	C_2H_4	409·3	382·4	1624 0	1517·5
Propylene	C_3H_6	599·3	559·1	2378·0	2218·5
Butylene	C_4H_8	789·3	735·8	3132·0	2919·5
Acetylene	C_2H_2	379·3	365·9	1505·0	1452·0
Benzene	C_6H_6	934·5	894·2	3708·0	3548·0

The following are some typical present-day examples of coal gas, carburetted water gas, and a mixture of coal gas and carburetted water gas:—

Coal Gas.

Constituents.	—	Volume per Cent. A.		Volume per Cent. B.	
Carbon dioxide . .	CO_2	1·67		2·28	
Olefines and density .	C_nH_m	3·34 $C2{\cdot}30H4{\cdot}60$	Gross. Net. B.Th.U. 591 | 525·5 (No. 2 "Metropolitan") 15·7 candles C.V. I.P.	3·08 $C3{\cdot}07H6{\cdot}14$	Gross. Net. C.V. B.Th.U. 561 | 498
Benzene.	C_6H_6	0·09		0·00	
Oxygen	O_2	1·49		1·57	
Carbon monoxide . .	CO	6·23		6·92	
Hydrogen	H_2	44·43		45·55	
Methane	CH_4	35·30		30·70	
Nitrogen	N_2	7·46		9 89	
Total . . .	—	100·01		99·99	

Carburetted Water Gas.

Constituents.	—	Volume per Cent. A.		Volume per Cent. B.	
Carbon dioxide . .	CO_2	3·11		2·55	
Olefines and density .	C_nH_m	8·37 $C2{\cdot}82H5{\cdot}64$	Gross. Net. B.Th.U. 557 | 510·5 (No. 2 "Metropolitan") 18·8 candles C.V. I.P.	6·58 $C2{\cdot}90H5{\cdot}80$	Gross. Net. C.V. B.Th.U. 542·5 | 497
Benzene.	C_6H_6	0·00		0·00	
Oxygen	O_2	0·89		0·79	
Carbon monoxide . .	CO	31·52		34·07	
Hydrogen	H_2	32·61		29·43	
Methane.	CH_4	15·69		17·99	
Nitrogen	N_2	7·80		8·59	
Total . . .	—	99 99		100·00	

Mixed Coal Gas and Carburetted Water Gas.

Constituents.	—	Volume per Cent. A.		Volume per Cent. B.		Volume per Cent. C.	
Carbon dioxide . .	CO_2	2·55		2·09		2·30	
Olefines and density	C_nH_m	3·87 $C2{\cdot}68H5{\cdot}36$	Gross. Net. C.V. B.Th.U. 528·5 | 472·5	4·71 $C2{\cdot}70H5{\cdot}40$	Gross. Net. C.V. B.Th.U. 592·5 | 530·5	3·99 $C2{\cdot}65H5{\cdot}30$	Gross. Net. C.V. B.Th.U. 543 | 484 I.P. (No. 2 "Metropolitan") 14 cndls.
Benzene . .	C_6H_6	0·00		0·27		0·00	
Oxygen . .	O_2	1·23		0·82		0·71	
Carbon monoxide . .	CO	13·03		12·06		9·30	
Hydrogen. .	H_2	44·08		44·47		44·19	
Methane . .	CH_4	25·39		29·00		27·77	
Nitrogen . .	N_2	9·84		6 58		11·74	
Total . .	—	99·99		100·00		100·00	

Analysis of Gas Containing Ethane.

As mentioned previously, this combustion apparatus is suitable for the analysis of coal-mine gas, or natural gas, where it is desired to ascertain the volume of ethane (C_2H_6) present. This cannot be determined directly from the results of an explosion with oxygen, as two volumes of hydrogen with two volumes of ethane has the same composition as four volumes of methane—thus:

$$2(C_2H_6) + 2(H_2) = 4(CH_4)$$

and, consequently, would give rise to the same products on explosion with oxygen, as pure methane—thus:

(*a*). $2(H_2) + 2(C_2H_6) + 8(O_2) = 4(CO_2) + 8(H_2O)$
(*b*). $4(CH_4) + 8(O_2) = 4(CO_2) + 8(H_2O)$

The volumes of methane and ethane can, however, be determined easily by means of combustion over heated black copper oxide, using the residual gas for the purpose.

The hydrogen, if present, is burned at a low red heat, and the contraction noted. The combustion-tube and gas must now be allowed to cool down to atmospheric temperature; and when the contraction has ceased to take place, the volume is again noted. The combustion-tube is then raised to a bright red heat, and the methane and ethane are oxidized to carbon dioxide and water vapour. The whole is again cooled to atmospheric temperature, and the volume noted at maximum contraction.

As methane produces its own volume of carbon dioxide, any increase between these two latter readings will be due to the ethane, which produces twice its volume of carbon dioxide. The increase in volume, divided by two, will represent the volume of ethane in the quantity of residual gas taken for combustion. If the volume of nitrogen be measured, the methane in this mixture can be ascertained by adding together the volumes of hydrogen and nitrogen and one-half of the expansion in volume due to the combustion of ethane, and deducting the sum of these three volumes from the total quantity of gas taken. Example:—

	C.C.
Volume of gas	33·60
Volume after combustion of hydrogen	20·10
Contraction (hydrogen)	13·50
Volume after cooling combustion-tube and gas .	7·50
Volume after combustion of methane and ethane and again cooling combustion-tube and gas . .	12·70
Increase in volume, due to ethane	5·20
Volume of ethane = $\frac{5{\cdot}2}{2}$ =	2·60
Volume of nitrogen residue	9·60
Volume of methane = 33·6 − (13·5 + 9·6 + 2·6) =	7·90

Below are some examples of natural gas:—

Constituents.	—	Percentage Volume.	
		Coal Boring.	Petroleum Well.
Carbon dioxide . . .	CO_2	0·00	0·30
Olefines	C_nH_m	0·00	0·60
Oxygen	O_2	0·30	1·20
Carbon monoxide . . .	CO	0·55	0·60
Hydrogen	H_2	0·00	14·00
Methane	CH_4	40·20	55·10
Ethane	C_2H_6	17·85	4·90
Nitrogen	N_2	41·09	23·30
Total	—	99·99	100·00

SOME NOTES ON SHADOWS.

At the conclusion of the discussion on Mr. S. B. Chandler's paper at last Friday's meeting of the London and Southern District Junior Gas Association, Mr. J. G. Clark, of the Gaslight and Coke Company (President of the Association), fulfilled his promise to address the members on the subject of shadows.

Mr. Clark said the subject of shadows was a very important aspect of the science of illumination. Without it, they would have no visual conception of a third dimension; and seeing that practically all their ideas of form and solidity depended upon gradients of light and shade, the absence of shadows would almost entirely deprive the human faculty of the power of discrimination of figure and form. He thought he was right in saying the eye was the most valuable of the human senses. By far the largest number of their conceptions, and the most valuable and lasting impressions, were acquired through its means. As one sometimes heard of a shadowless illumination, it might be interesting to ascertain how far such a statement was true. Obviously, it could not be absolutely true; for, as pointed out, such a condition of things would be abominable. "Shadowless illumination" appeared to be a term applied to systems of lighting which had an effect resembling diffused daylight. Diffused daylight illumination, however, was not "shadowless," as must, of course, be apparent to anybody with an appreciative eye to architecture. But if they limited their ideas to the illumination of a horizontal surface, diffused daylight might be described as shadowless. When daylight was received from a sunless sky, any particular point of a horizontal surface (the ground) was receiving light from the whole of the area of the sky visible from that point; and an object standing there would not cast any visible shadow on the ground. If, however, it was possible to blot out the sky except for a small portion of its area, it would be found that the light from the small exposed area would cast a shadow; and if other small areas of the sky were exposed, a shadow would be cast by each one. If this process of gradually exposing the sky was carried on until the whole of it was visible, the numerous shadows would blend into each other until their individuality would be lost—*i.e.*, the illuminated area of the ground would be a large and uniform shadow, and, in practical effect, shadowless. The light and shade effects which gave beauty to architecture were due almost entirely to the difference in brightness of the primary and secondary light sources. They might, for instance, imagine a piece of statuary, the surfaces of the stone of which might, for the present purpose, be divided into three classes—namely, those which received their light (1) direct from the sky, (2) from the ground, and (3) partly from the ground and partly from the sky. Owing to the low reflectivity of the ground, the surfaces which were illuminated by it were less bright than those illuminated by the sky; and between these two extremes a wide gradation existed which gave solidity and form to the stone relief. The inner recesses of the relief did not receive light direct from the sky or from the ground. The illumination there was due to multiple reflection from the surface of the relief itself, and formed the deep shadows.

The same condition, Mr. Clark pointed out, held in the case of indirect artificial lighting—that was to say, in those systems in which the rays from the primary light source were directed first to the ceiling, whence they were reflected downwards. Such a method was "shadowless" in the same sense as daylight; the poor reflecting power of the floor as compared with the ceiling being largely responsible for the light and shade contrast. This was illustrated by some interesting experiments recently carried out by Mr. Justus Eck. It would be seen from what he had said that under diffused daylight the lower surfaces were less brightly illuminated than the upper surfaces. If, therefore, the lower surface had a higher co-efficient of reflection than the upper surface, the contrast, or light and shade, would partly disappear. Let them, for example, assume the upper surface to have an illumination of 10 foot-candles and a co-efficient of reflection of 40 per cent., its actual surface brightness would be $10 \times \frac{40}{100} = 4$ foot-candles. If the lower surface had an illumination of (say) 5 foot-candles, and a co-efficient of reflection of 80 per cent., the actual surface brightness would be $5 \times \frac{80}{100} = 4$ foot-candles, or the same as the upper surface. Under such conditions, the light and shade contrast would disappear entirely; the difference in the illumination of the two surfaces being compensated for by the difference in their co-efficients of reflection.

An aspect of shadows that he might conveniently deal with, proceeded the President, was that of the effect of opaque objects near a source of light. Columns and staunchions were sometimes encountered in interiors; and these would cast shadows the intensity of which would vary with the kind of light-source used. A shadow might be eliminated in two ways—by removing the opaque object, or by increasing the area of the light-source and so extending the area covered by the shadow. While the first method was, of course, quite impracticable, the second was often applied. The area of the light-source might be extended by increasing the number of mantles or by using reflectors. A reflector really acted as a secondary source of light; and, owing to its

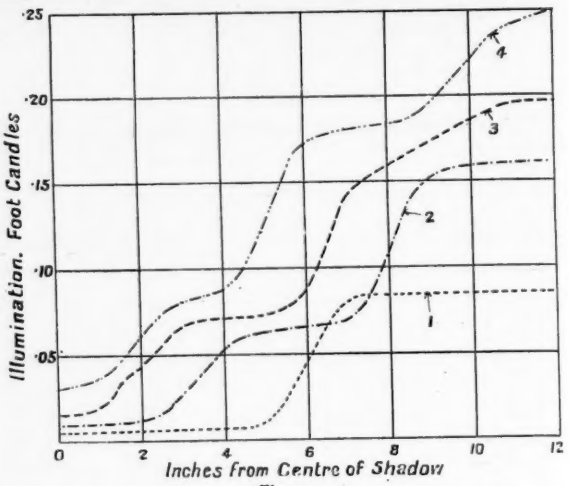
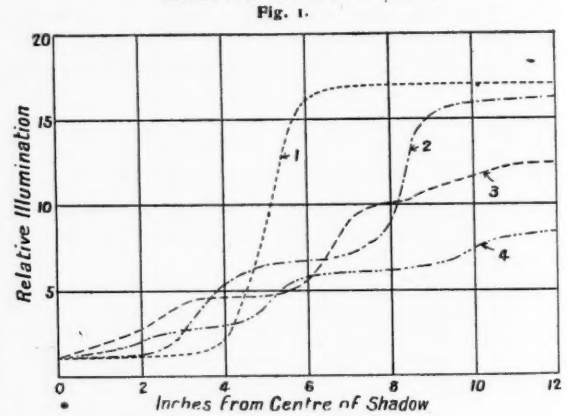


Fig. 1.



No. 1 Curve . . . One Mantle
No. 2 ,, . . . Two Mantles
No. 3 ,, . . . Three Mantles
No. 4 ,, . . . Do. Do., with reflectors

Fig. 2.

comparatively large area, it did much to reduce the intensity of shadows. An account of an experiment which had been repeated in various ways by the gas supply students at the Westminster Technical Institute was interesting, as showing the effect of an increase in the area of the light-source on the definition of a shadow. A three-light inverted lamp was set up 8 feet from the ground; and a post (a piece of 3-inch quartering) was set up perpendicularly, and 5½ feet from the centre-line of the lamp. The experiment consisted in measuring the illumination transversely across the shadow at various points, starting at the centre—a Trotter photometer being specially arranged for this purpose. The definition of a shadow at any point was determined by the contrast of the illumination at this point with that immediately adjacent thereto, so that the rate of change of illumination across the shadow was a measure of its definition or sharpness. The illumination in the region of this shadow was explored under the following conditions: (1) One mantle, with no reflector; (2) two mantles, with no reflector; (3) three mantles, with no reflector; and (4) three mantles, with a reflector. The results of these observations were shown in fig. 1. The illumination at the centre of the shadow was very low; but it was interesting to note the rate of charge in the illumination, because it was this quantity that gave definition to the shadow. Fig. 2 showed the same results, taking as unity the illumination at the centre of the shadow in each case. These curves represented the contrast values. The "cascade" characteristic was conspicuous in each case. It would be noticed that the curve tended to straighten out as the area of the light-source was extended, until, when three mantles and a reflector were used, the curve (No. 4) was almost a straight line. A perfectly straight line would, of course, indicate a practically invisible shadow.

SOME NOTES ON THE EFFICIENT RUNNING OF GAS-ENGINES.

By R. Wardell, of Cambridge.

[A Paper read before the Eastern Counties Gas Managers' Association, April 24.]

With the increasing competition from electric motors, it is, I think, necessary that closer attention should be paid to the proper and periodical adjustment of the various working parts of a gas-engine than has been generally given in the past. Hence my choice of a paper dealing with this subject, which I trust will be of some service to the members.

In my opinion, good efficiencies can only be obtained and maintained by a systematic inspection carried out periodically by competent men. Fair results are, no doubt, achieved under the eye of the ordinary man in charge; but if the best results are to be got, it is essential that an engine should be overhauled from time to time, owing to the wear of rollers, cams, &c., and other disturbing causes.

You will, I think, agree that it is incumbent upon gas companies and corporations to satisfy their consumers, and that which we are doing for gas-cookers, gas-fires, and incandescent burners in the way of periodical inspection must be done also for gas-engines, if we are to develop this very important branch of the gas industry.

In a recent lecture, Professor Burstall, speaking about the installing of gas-engines, aptly stated that "the old system of installation was to put the engine in a convenient corner, fence it round, start it working, and leave it to run by itself." This, unfortunately, was only too true with reference to the past; but it is satisfactory to note that those days have been superseded, and engines are now usually fixed in clean, suitable places, secured to substantial foundations, and more attention is given to them.

It is with the principal disturbing factors which affect good running that I propose to deal—viz., temperature of the ignition-tube, mixture of gas and air, pressure of gas supply, calorific value of the gas, temperature of the water-jacket of the cylinder, and valve-settings.

Temperature of the Ignition-Tube.

The temperature of the ignition-tube plays a very important part in the efficient running of a gas-engine, as will be seen from the tests carried out and given in Table I.

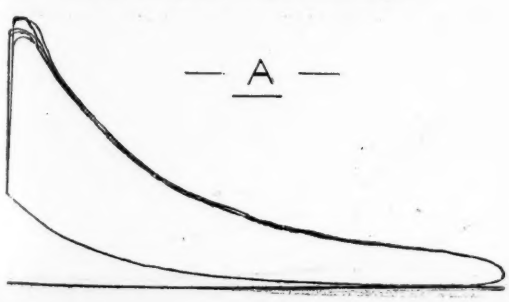
Table I.—*Variations in Temperature of Ignition-Tube.*

[See Diagrams A, B, and C.]

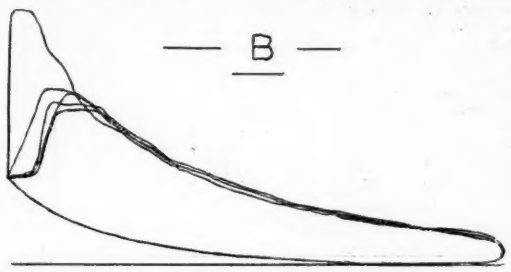
—	Test A.	Test B.	Test C.
Temperature of ignition-tube, deg. Fahr.	1,400	1,112	1,022
Temperature of cylinder water-jacket, deg. Fahr.	125	131	131
Pressure of gas supply, inches of water	15-10ths	15-10ths	15-10ths
Barometric pressure	29·37	29·37	29·39
Temperature of gas, deg. Fahr.	59	65	68
Calorific value of gas, B.Th.U. net	523	520	525
Gas consumed, corrected, cubic feet per hour	422	485	583
Engine speed, revolutions per minute	188	188	186
Diameter of brake circle, inches	76	76	76
Weight on brake, pounds	171	171	171
Brake horse power	19·38	19·38	19·28
B.Th.U. per B.H.P. hour	11,390	13,010	15,880

In the series of tests, the temperature was obtained by sighting a Féry radiation pyrometer on to the ignition-tube through a 1-inch hole drilled near the base of the chimney. A fire-clay plug was inserted in the hole to prevent cold air impinging upon the tube, and was withdrawn to take the readings. A Féry recording calorimeter was used to ascertain the calorific value of the gas; and the load was put on the engine by means of a Prony brake fitted to one of the fly-wheels. The indicator diagrams were taken by a M'Innes-Dobbie indicator.

In the first test, the tube temperature was 1400° Fahr. (a bright red), and the gas consumed on a load of 19·38 B.H.P. was 422 cubic feet per hour, equivalent to 11,390 B.Th.U. per B.H.P. hour. Diagram A shows the regular firing of the charges.

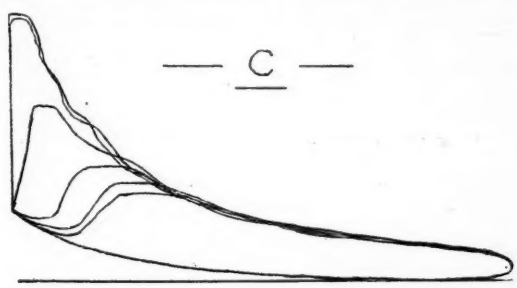


The temperature of the ignition-tube was then lowered, by checking the bunsen burner, to 1112° Fahr., and a second set of readings taken. You will observe from Diagram B the irregular firing of the mixture at this tube temperature, and the B.Th.U. per B.H.P. hour rose from 11,390 to 13,010.



The temperature was then further reduced to a dull red (1022° Fahr.), and readings again taken. With practically the same load on as in the two previous tests, the gas consumed was 583 cubic feet per hour, or an increase of 161 cubic feet, equal to 38 per cent., over test A.

At this temperature the firing was very irregular and late, as you will see in Diagram C. For the greater part, the firing was much too late, with the result that the explosive force simply followed the piston without attaining its maximum thrusting effort,



and the compression pressure frequently fell from 107 lbs. to 70 lbs. per square inch, due to the expansion of the gases, before ignition took place. All this results in loss of gas, and is by no means an extreme case, as I have frequently seen engines working with the ignition-tube no hotter than, and in many cases not so hot as, in this particular test. It is to be noted that the calorific value of the gas, the proportion of gas to air, pressure of gas supply, temperature of cylinder water-jacket, and the other conditions, were fairly constant throughout the three tests. These figures, therefore, appear to establish the necessity for careful attention to the bunsen burner, and the keeping of the ignition-tube at a good heat, if economical working is to be maintained. The burner should be kept clean, and the asbestos lining of the chimney renewed from time to time.

Electric ignition is often used instead of tube-ignition, and it has some undoubted advantages. One of the principal claimed is that it will more readily fire a weak mixture than will tube-ignition, and so save a lot of partially useless charges such are seen in (say) Diagram E. On the other hand, more skilled attention is perhaps required in both the high and low tension systems than is the case with tube ignition.

Trouble frequently arises through the spark failing to pass properly, due to the contacts becoming dirty, or, having worn away, failing to come into contact properly, with the result that the initial point of ignition is retarded, and power is thereby lost. Another source of trouble is pre-ignition, which is sometimes brought about by the contacts wearing and getting sufficiently hot to ignite the gases before the spark passes. This drawback is also common to tube ignition, where the timing-valve, or the cam or roller which actuates it, is allowed to become unduly worn.

With the growing demand for very steady running, such as is required for driving dynamos for electric lighting purposes, quality governing is taking the place of hit-and-miss governing. With this system an explosion takes place every cycle, no matter how light the load. The proportion of gas to air is varied as the load varies. The greater the load, the greater the proportion of gas to air; and, conversely, the lighter the load, the less the proportion of gas to air.

In this way the explosion pressures are varied to suit the load; and with an explosion occurring every cycle, the cyclic variation in the speed of the engine is small; and the voltage of a dynamo driven by an engine governed in this manner can be kept very steady. On light loads, the mixtures are weak; and it is here that tube ignition must give way to the superior advantages of electric ignition, in order to ensure the charges being fired promptly.

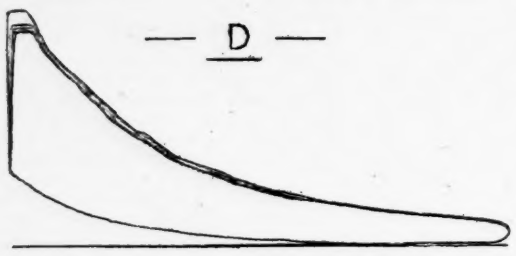
Proportion of Gas to Air.

The second series of tests (Table II.) were carried out working with different proportions of gas to air.

TABLE II.—*Different Proportions of Gas and Air.*

[See Diagrams D, E, F, G, H.]

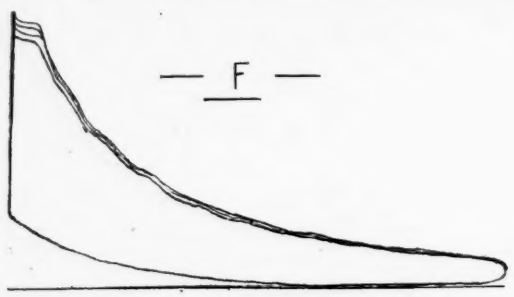
—	Test D.	Test E.	Test F.
Temperature of ignition-tube, deg. Fahr.	1,400	1,400	1,391
Temperature of cylinder water-jacket, deg. Fahr.	135	133	129
Pressure of gas supply, inches of water	15-10ths	15-10ths	15-10ths
Barometric pressure	29·47	29·47	30·10
Temperature of gas, deg. Fahr.	71	70	63
Calorific value of gas, B.Th.U. net	534	537	515
Gas consumed, corrected, cubic feet per hour	413	565	446
Engine speed, revolutions per minute	188	186	188
Diameter of brake circle, inches	76	76	76
Weight on brake, pounds	171	171	171
Brake horse power	19·38	19·28	19·38
B.Th.U. per B.H.P. hour	11,380	15,730	11,850
Admixture (gas and air)	correct	too weak	too rich



With a mixture giving regular explosions, as shown on Diagram D, the gas consumed on a load of 19·38 B.H.P. was 413 cubic feet per hour, or 11,380 B.Th.U. per B.H.P. hour. The gas-valve was then partially closed, and a test made working with

the resultant weaker mixture. Diagram E shows the late ignition due to the weak charges; and the gas consumption, with almost the same load on as before, rose to 565 cubic feet per hour, or an increase of 152 cubic feet, equal to 37 per cent.

The third test (Diagram F) was made with too rich a mixture; and you will note the violence of the explosions. The indicator piston was repeatedly sent hard up to the stop; and the initial

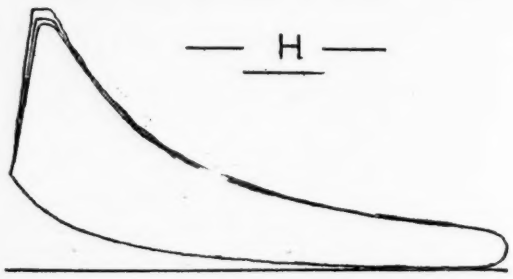


explosion pressures were probably not less than 400 lbs. per square inch. Such violent explosions are not conducive to economical running, as a very heavy strain is thrown on the working parts of the engine, and the wear and tear are thus made greater. Apart from this, the gas consumption was also greater on the same load than when working with the mixture used in Test D; so that the loss becomes twofold—more gas is used, and the cost of repairs is heavier.

The position of the gas and air valves should therefore be found at which the best results are obtained. This should be done whenever an engine is installed to suit the local conditions, such as the calorific value of the gas, the pressure of supply, and the mean average load to be put upon the engine. Working with too weak a mixture on hit-and-miss governing with tube ignition is a common source of trouble, and is frequently the cause of inefficient working.

Diagram E is not an unusual one, and may be taken as a type of card too frequently met with. As an instance of this, I will cite one of many cases that have come under my notice. A large firm of manufacturers complained strongly about the amount of their gas bill for gas used in one of their engines, and this after a considerable sum of money had been spent on renewals. As usual, the accuracy of the meter was doubted; and they were threatening to instal either suction gas or electric-motors. Upon investigating the matter, I found the engine was working with too little gas. It was indicated on the normal daily load, and Diagram G is a copy of the cards taken. There you will see how

very late the firing was, due to the mixtures being so weak. The gas consumed was 780 cubic feet an hour. The gas and air valves were adjusted, and the engine was again indicated on the same load as before. Diagram H is a copy of the cards taken after adjustment. The gas consumption fell to 564 cubic feet an hour —a reduction of 216 cubic feet, which represented a saving of nearly 28 per cent. The cause of the excessive consumption of gas was explained to the satisfaction of the consumer, and neither suction gas nor electric-motors were installed.



An interesting case of an engine working with a low proportion of gas to air came to my notice as the result of a complaint with regard to heavy gas consumption. It was an 80 B.H.P. engine fitted with two light fly-wheels. The excessive cyclic variation, due to the light fly-wheels, caused the belts right along the main line of shafting to "snatch" at every impulse of the engine; and the belts frequently broke. To prevent this, the driver had chosen to use a weaker mixture, with consequent less violent explosions. This gave steadier running, and prolonged the life of the belts at the expense of economy in gas consumption. Heavier fly-wheels were suggested to overcome the trouble.

PRESSURE OF GAS SUPPLY.

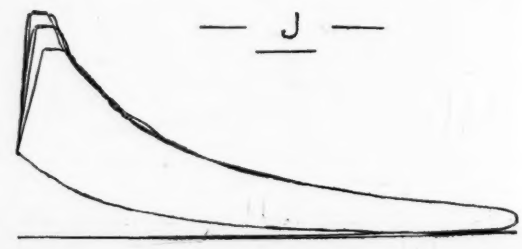
Table III. deals with variations in the pressure of the gas supply; the other conditions being kept approximately constant throughout.

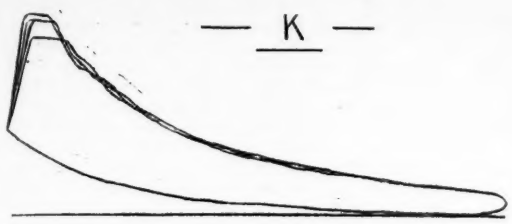
TABLE III.—*Alterations in Pressure of Gas Supply.*

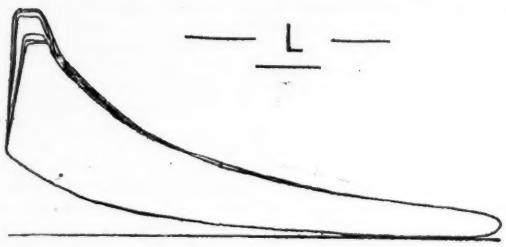
[See Diagrams J, K, L, M.]

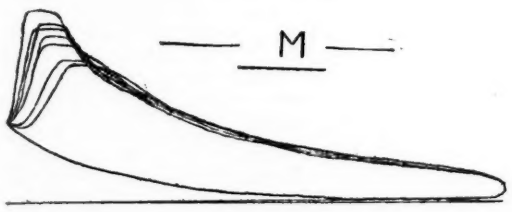
—	Test J.	Test K.	Test L.	Test M.
Temperature of ignition-tube, deg. Fahr.	1,400	1,382	1,328	1,130
Temperature of cylinder water-jacket, deg. Fahr.	127	129	142	145
Pressure of gas supply, inches of water	15-10ths	25-10ths	10-10ths	7-10ths
Barometric pressure	30·51	30·51	30·51	30·51
Temperature of gas, deg. Fahr.	62	63	67	69
Calorific value of gas, B.Th.U. net	520	518	522	529
Gas consumed, corrected, cubic feet per hour	561	580	573	592
Engine speed, revolutions per minute	182	182	182	182
Diameter of brake circle, inches	76	76	76	76
Weight on brake, pounds	235·50	235·50	235·50	235·50
Brake horse power	25·84	25·84	25·84	25·84
B.Th.U. per B.H.P. hour	11,290	11,620	11 580	12,120

With a pressure of 15-10ths, the gas-valve was set and regular ignitions obtained, as shown in Diagram J. With the engine









developing 25·84 B.H.P., the gas consumed was 561 cubic feet an hour, equal to 11,290 B.Th.U. per B.H.P. hour. Pressures were afterwards taken above and below 15-10ths, with the gas-valve in the same position throughout. At 25-10ths, the gas used was 580 cubic feet, and at 10-10ths 573 cubic feet, an hour. The pressure was further reduced to 7-10ths, and the firing became irregular owing to the weaker admixture, and also to the temperature of the ignition-tube being lowered. The lower pressure disturbed the adjustment of the bunsen; and the temperature of the ignition-tube fell to 1130° Fahr. The gas used was 592 cubic feet, or 12,120 B.Th.U. per B.H.P. hour.

At the lower pressure, pulsation of the gas in the main was noticeable. This was caused by the anti-fluctuator in the gas-bag being practically thrown out of action owing to the sluggishness of the gas at this pressure. The valve was nearly wide open the greater part of the time, and the engine piston sucked on to the main. It would therefore seem that, in order to ensure economical working, engines should be supplied with gas at constant pressure. Governors are not expensive, and the resultant saving in gas would appear to justify the expenditure.

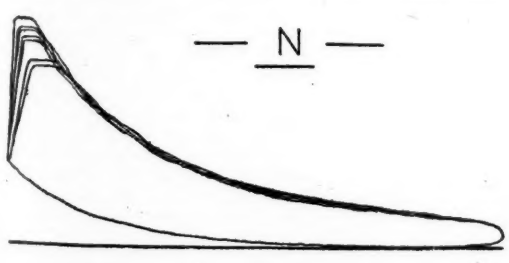
Calorific Value of Gas.

Variations in the calorific value of the gas form another disturbing factor; and Table IV. deals with tests carried out on two different qualities of gas.

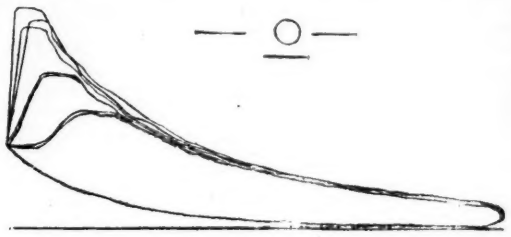
Table IV.—*Gases of Different Calorific Value.*

[See Diagrams N and O.]

—	Test N.	Test O.
Temperature of ignition-tube, deg. Fahr.	1,391	1,400
Temperature of cylinder water-jacket, deg. Fahr.	131	131
Pressure of gas supply, inches of water	15-10ths	15-10ths
Barometric pressure	30·13	30·10
Temperature of gas, deg. Fahr.	68	66
Calorific value of gas, B.Th.U. net	536	501
Gas consumed, corrected, cubic feet per hour	421	493
Engine speed, revolutions per minute	185	186
Diameter of brake circle, inches	76	76
Weight of brake, pounds	178	178
Brake horse power	19·85	19·96
B.Th.U. per B.H.P. hour	11,370	12,370



In the first case, the calorific value was 536 B.Th.U. net; the gas used on a load of 19·85 B.H.P. was 421 cubic feet an hour; and the pressure of supply was 15-10ths. Another holder was then put on, and a second test made with gas having a heating value of 501 B.Th.U. net per cubic foot. The gas consumption rose to 493 cubic feet an hour with the engine doing the same amount of work as before. The position of the gas-valve was not altered; and it will be noted that the other respective readings were nearly alike in both cases. The increased amount of gas used was due to the admixture being weaker and the charges fired more or less irregularly. Diagram O shows the late ignition of some of the charges.



In view of the tests given in Tables III. and IV., I am of opinion that efficient running calls for gas being supplied at constant pressure, and constant, or nearly so, calorific value. With these conditions constant, the gas and air valves could be adjusted to give the best result, and would not require further attention.

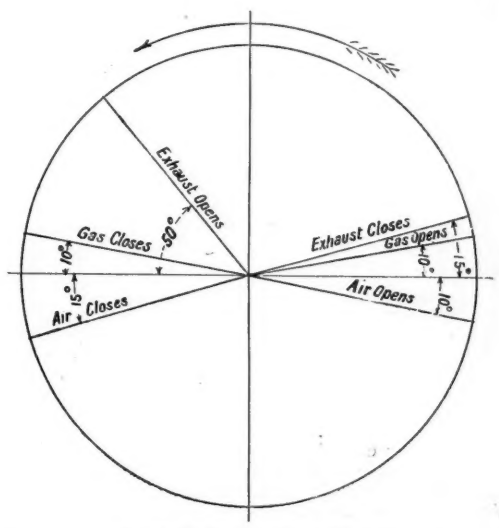
Temperature of Cylinder Water-Jacket.

The circulation of the water in the cylinder should be carefully watched. The temperature of the water as it leaves the jacket ought to be about 140° Fahr. If it is much below this, the cylinder is chilled, and quite an appreciable amount of power is lost, owing to a portion of the heat in the gases at the time of explosion and expansion being dissipated through the walls of the cylinder instead of doing useful work behind the piston. On the other hand, if the temperature of the jacket is allowed to get too high there is a risk, with the present-day high compression pressures, of pre-ignition taking place. Pre-ignition should be checked at once whenever detected, otherwise a serious breakdown will inevitably happen, sooner or later. It also involves great loss of power. Cooling-tanks of ample capacity should be provided, to enable the attendant to keep the jacket at the right temperature.

Valve-Settings.

It is important that all valves should open and close at the right moment; if they do not, economical running is interfered with. They should be examined from time to time. Valve-settings vary slightly with the various sizes and types of engines; but the following figure may be taken as representing an average setting for an engine working on town gas.

Admission-Valve.—Generally speaking, this valve opens about 10° before the crank reaches the inner centre on the exhaust stroke, and closes from 15° to 25° after the crank has reached the outer centre and has begun the compression stroke. By so doing, the full effect of the impetus imparted to the gases on entering the cylinder by the suction of the piston is taken advantage of, and



Crank Angles of Valve Setting.

the gases are well mixed and the cylinder filled. The valve must not, however, be left open too long, or else compression begins too late. It is opened before the suction stroke begins to make use of the inductive effect set up by the velocity of the departing gases, and so draw in a supply of air to scavenge the cylinder. If spent products are left behind, the next charge is more or less diluted, and the economy of the engine is lowered.

Gas-Valve.—This opens about 10° after the induction stroke has begun, and closes 10° before the stroke is completed.

Exhaust-Valve.—This is generally opened from 50° to 67° before the end of the expansion stroke, and closed from 15° to 20° after the crank has reached the inner dead-centre and is on the induction stroke. By opening early in this manner, the terminal pressure is such that considerable momentum is given to the products of combustion. This assists the piston in their expulsion, and also keeps down the back-pressure on the exhaust stroke. If opened too early, the mean effective pressure is reduced, and the consequent late closure prevents the proper induction of the next charge. On the other hand, if the exhaust-valve leaves its seat too late, the back-pressure is increased; and as late opening means early closure, the cylinder is not cleared of the waste gases, and the fresh mixture coming into contact with these hot gases is rarefied and diluted, which means loss of power and economy.

Importance of Engine Examination.

From these few remarks on valve-settings, together with the tests previously explained, it will be seen how important it is that engines should be examined from time to time. The question then arises, Who is to do it? Personally, I think the time has come when this work should be taken up by ourselves—the suppliers of gas—if we are to maintain and strengthen our position in the field of power. We have awakened to the necessity for the systematic inspection of gas-cookers, gas-fires, and incandescent burners, but as yet appear to be slumbering on, in a measure, with regard to gas-engines. The increased business, and the satisfaction given to consumers resulting from the free inspection of the first-named appliances, have amply justified the expenditure involved; and I feel sure that the same would apply to the free inspection of gas-engines.

Cases similar to the one quoted (see Diagrams G and H) are, I am afraid, of common occurrence, and have probably led in many instances to gas-engines being superseded by electric-motors. Regular inspections by competent men would prevent all this, satisfy the consumer, and lead to increased business. We cannot overlook the fact that electric-motors possess certain advantages over gas-engines. Modern, well-designed motors require little attention. Improvements in the magnetic field, armature, and brush gear have overcome commutator troubles to a great extent, and have so done away, in a large measure, with one of the sources of trouble. The cost of upkeep is low. The system is more flexible; a motor can be readily fixed on moving machinery, such as stoking-machines, or placed on (say) wall-brackets, to suit prevailing conditions. They are cleaner. They can be easily started and stopped, and are therefore suitable for intermittent working. They can be used (when totally enclosed) where the atmosphere is laden with dust and gritty matter. Expensive foundations are not required. The cost of energy is, however, considerably greater than for gas-engines; and herein lies the salvation of the latter.

It is for us to see that this difference in cost is maintained, by preventing leakages of power as depicted in the foregoing tables. It is often the summation of such leakages which reduces this difference; and it is then that the risk is run of the electric-motor creeping in and ousting the gas-engine.

Fitters who have served their time in one or other of the various gas-engine works, and who have been on the test-bed, are the class of men to be chosen for this work of inspection. If this were done, our position would be strengthened, and our confidence increased as to the future of gas for motive-power purposes.

Discussion.

The President (Mr. Paternoster) expressed the hope that the paper would receive a good discussion.

Mr. J. T. Jolliffe (Ipswich) congratulated Mr. Wardell upon the information he had given the members. All of them who had gas-engines in their districts found the troubles the author had mentioned prominently brought before them. They also found that the repairing of gas-engines by outside gas-fitters gave them more difficulty than anything else, because the fitters were often employed in preference to the gas company, and, when they were sent to the jobs, it was invariably asserted that the trouble was due to the gas supplied by the gas company. They had their attention drawn to this very markedly the other day. One of the large manufacturers in their town, who was a great consumer of gas, made the usual complaint. They sent down a man after an outside engine fitter had been there; and the Company's man found that there was only some small adjustment that wanted to be put right. Then the engine started off properly. However, these difficulties arose; and Mr. Wardell had shown them, by his charts, where they came in. From the charts they would therefore be able to derive valuable assistance. There was only one point upon which he could not feel quite so happy as apparently Mr. Wardell was—that was, that the cost of energy with electric-motors was considerably greater than in the case of gas-engines. This was only true up to a certain figure. In his own case, the Corporation were supplying large manufacturers with electric energy at a fraction over ½d. per unit. He was afraid a gas engineer would have some difficulty proving to a consumer that gas was cheaper in such cases than electric current, more especially when the manifest advantages of electric-motors were taken into consideration.

Mr. A. E. Broadberry (Tottenham) complimented Mr. Wardell upon the manner in which he had set about threshing out the points that he had brought before them; and they would all, he was sure, find the paper a useful one for reference. They had a great many gas-engines in the Tottenham and Edmonton Gas Company's district. The Company let them out on hire, and had found it necessary to introduce a system such as Mr. Wardell had outlined—that was to say, a periodical inspection of the engines. They not only inspected the Company's engines, but they also undertook the work in the case of privately owned engines. With regard to the comparative cost of gas and electric power, he might mention that about a month since the proprietors of one fair-sized works in their district owning their own gas-engine told him they were going to arrange a competition between gas and electricity—in fact, they had the electric-motors all in position ready for testing them. The firm very kindly thought he (Mr. Broadberry) would like to know beforehand that a test was to take place. He replied that he should be very pleased to have particulars of the test, and that, so long as the gas-engine was in proper adjustment, he had no fear of the result. With their gas at 2s. 2d. per 1000 cubic feet—he believed, though he was not quite sure, the electric quotation was 1d. per unit; anyway, it was not above that figure—he (Mr. Broadberry) had no doubt whatever as to the result, if they were going to decide the issue on cost. The firm then gave him an opportunity to send round a man from the Company to examine the gas-engine, and to satisfy himself that it was in proper adjustment. They found the engine was rather badly worn, and every adjustment was about as wrong as it could be; so they put it in order. The result was that the electric-motors had been removed; and the firm sought his (Mr. Broadberry's) advice about revising some of the shafting in the shops. There was not the slightest doubt, if they continued to satisfy the users of gas-engines, they need not fear their competitors. He believed that this fully justified what Mr. Wardell recommended in his paper; and he further believed that the time had come when they must adopt some such system of inspection as he had outlined.

Mr. T. Glover (Norwich) said, like some other speakers, he had had some experience with comparisons of gas-engines good and bad, and with gas-engines and electric-motors. He thought the first duty of a gas company was to have as many gas-engines on their own works as possible, and to get as much experience as possible from the use of these engines. In his own case, they generated compressed air and electricity for driving their stoking machinery and coke-conveyors from good sized gas-engines. They had them in duplicate; and they got from them some very good experience with which they should be able to help their consumers on the district who had gas-engines. These consumers were beginning to call upon the Company to do necessary inspection and repairs from time to time. The Company also volunteered inspection; and in some instances with good results. He had an interesting experience on just now. It was the case of a shoe factory in Norwich that had hitherto been driven with electric-motors. The owner of the factory was very dissatisfied with the cost of his power; and the Company had placed an estimate before him as to the cost of running a gas-engine, with the result that they got an order for a good sized gas-engine to take the place of the electric-motors. When they were making final negotiations for this order, the electric people were (as it were) waiting on the doorstep to secure an order for a large motor to take the place of the small units which drove separate machines. This might interest the members, because it was one of the claims of the electric people that, instead of having lines of shafting and keeping one big motor going, they could have small units, and run the machines separately. But it appeared that the small units were much more expensive to run than one large electric-motor. Different circumstances must regulate action. The circumstances of a steady load at this boot factory enabled the Gas Company to get in with a gas-engine, and turn out the small electric-motors. It was also a good policy to have differential rates for industrial gas—not only for power, but for all sorts of industrial purposes, such as tool and furnace heating. They had been able to get in with this 50 H.P. engine because, by using gas for power and other industrial purposes, manufacturers could buy it in their case for 1s. 9d. per 1000 cubic feet. If the gas had been sold at the ordinary lighting rate, they would have had no chance whatever; and he was sure that increasing the day load so as to level it up with the night load, and the summer load to match the winter load, meant both a saving in plant and economical results in regard to labour, and justified them doing what the electrical people were doing in having differential rates for large consumptions for industrial purposes. He had quite enjoyed listening to the paper. It had pointed out to them clearly and distinctly the need for having gas-engines tested from time to time, and proper diagrams taken. Only diagrams could reveal to them what was actually taking place in the engine cylinders. Mr. Wardell had not said anything about the governing of engines, or made comparison of the hit-and-miss system with the throttle-valve system. Where very steady running was needed, he (Mr. Glover) supposed it was advisable to have the throttle-valve system in place of hit-and-miss governing. He should like to know Mr. Wardell's experience, if he had had any, as to the relative economies of the two methods of governing. Where it was a case of competing with the public supply for electricity, it was important they should have a heavy fly-wheel for an engine that was to be used for generating electricity, and probably in conjunction with throttle-valve governing, rather than hit-and-miss. They had now with private plants to go into direct competition with public electricity. In

a case like the one he had quoted, for instance, it was quite possible the firm might go in for electric lighting with electricity generated from a gas-engine.

Mr. J. ANDREWS (Langley Mill) said he had been working recently on similar lines to those laid down by the author of the paper; and he had some diagrams in his possession which would put Mr. Wardell's to shame for badness, and not for their superior quality. He had had similar experience to the author in regard to the inefficiency of engines; and on examining the engines (by indicating them) he had found as much as 30 per cent. waste in gas. But all this was mere matter of his own history, and was not very important to the members. What was, he thought, perhaps of more importance to the meeting was the proposal of the author of the paper that they ought not only to undertake the inspection but the adjustment of engines. He (Mr. Andrews) went further than this; he also undertook repairs on a fairly large scale. They had provision for making piston-rings and casting brasses, and for providing almost everything that was necessary. He had a contract for the casting of liners, and they fitted them on the premises at a low cost. Being able to do the repairing at a low cost, it added very much to the popularity of gas power. Since he started this process of doing business (which he supposed they would call a very democratic process), the gas-engines in the district had increased from something like 50 or 60 H.P. to about 1400 H.P. With regard to the price of gas, he thought this was a very important factor. Their lowest price was 1s. 4d. per 1000 cubic feet; and at this price he thought they were able to compete with any other power that was likely to come into competition with them.

Mr. J. H. BREARLEY (Longwood) said that he had listened with great interest to Mr. Wardell's paper. It was of a type that appealed to him somewhat strongly, because he felt that the staffs of gas undertakings ought to know a little more about gas-engines than they did at the present time—that was, if one could take as a criterion the answers to the examination-papers in gas supply. While he had been sitting there, he had been estimating the number of times in the honours grade that questions set on gas-engines were answered. One question that related to the overhauling of gas-engines was attempted by 34 out of 93 candidates sitting. Another question dealt with various diagrams produced under different conditions; and this was attempted by 27 out of 80 candidates sitting. Yet the subject of gas-engines was specifically mentioned in the syllabus of the gas-supply examination. At Longwood, they had now for the past four or five years made a practice of taking indicator diagrams whenever they had had any complaint as to gas-engines being faulty. But they had not done this systematically. He was pleased to say that, so far as he knew, he had not had a single gas-engine displaced by an electric-motor. The price of gas for lighting was 2s. 5d.; and for power they had a differential rate running from 2s. to 1s. 8d. net. With these prices, they were quite able to hold their own. He could not understand his friend at Langley Mill coming down to 1s. 4d., unless it was for an abnormally large engine. Their electric competition at Longwood was as great as it was in other parts of the country. Electrical energy was now being offered at ⅛d. per unit. He had been rather interested in Diagram O. He thought it showed the effect of calorific power upon the gas consumption. He noticed that by the reduction of approximately 7 per cent. in the calorific power, there was an increase of 16 per cent. in the gas consumption. He should not have thought the increase would have been quite so much as this. He would like to ask Mr. Wardell if he had taken any test by reversing the position. For example, they had one test with gas of 536 B.Th.U., and then another test was made with gas at 501 B.Th.U. These comparative tests were made without any other alteration than that of the calorific value. He would like to know if the author ascribed the result to perfect adjustment for the 536 B.Th.U. Now supposing they had ideal conditions in the matter of adjustment for gas of 501 B.Th.U., and then, without making any other change, they used gas of 536 B.Th.U., what would be the result?

Mr. W. B. FARQUHAR (Ilford) said the question of the pressures to gas-engines was a very essential point, as this was one of the sources of the breakdown of engines; and it was a great point to see that the gas-bag was kept well supplied from the leading service. He had had experience with services laid to gas-engines, which services had been afterwards tapped to supply private houses. The result was that they obtained fluctuations on the services; and, owing to the fact that the supply was very sluggish, and would not keep the gas-bag filled, they obtained variable results with the engines. To overcome the difficulty of fluctuation in the service, there were two methods. One method was to increase the service right through. Another method was to put in a large piece of cast-iron main—say, about 6 inches diameter—beyond a point where the house branches were taken off, from which the gas-engine could draw; and this, forming a cushion, prevented fluctuations getting back to the houses. This only prevented fluctuations; it did not help the supply to the engine. The point in the paper that made him refer to this was under the head of "Pressure of Gas Supply," where the author said: "It would therefore seem that, in order to ensure economical working, engines should be supplied with gas at constant pressure." This he (Mr. Farquhar) thought ought to be qualified by stating at constant pressure, and also at adequate pressure. He thought that attendants on gas-engines were sometimes responsible for electric-motors being put in, as they wanted to get rid of the little trouble that had to be expended in starting the gas-engines and generally looking after them.

The PRESIDENT said he had not anything to add to the discussion, except to thank Mr. Wardell for the information he had given them, which he was sure would prove useful. It was one of those papers which might have been distributed among the members before the meeting; and then they would have been able to criticize it, or have brought forward comparative figures. They were pleased to see Mr. Wardell at their meetings. He was a new member of the Association, and had started well by reading this paper.

Mr. WARDELL, in replying to the discussion, said he rather thought Mr. Jolliffe was under the impression that he advocated the employment of outside fitters.

Mr. JOLLIFFE: I did not misunderstand you. What I meant to convey was that a great many manufacturers, in our town at all events, seem to prefer to employ local fitters rather than the Gas Company's men.

Mr. WARDELL said that at Cambridge they employed competent men who had been trained on the test-bed, and were competent to take indicator diagrams, and to tune-up an engine as it ought to be tuned-up. If an engine was examined about twice a year by a man of this description, they would have fewer complaints than at present as to heavy gas bills. Mr. Jolliffe also spoke of cheap electricity supply; and he (Mr. Wardell) thought that was all the more reason why they should employ men of this description. He thought if they went down to prices between 1s. 6d. and 2s., they need not have much fear of electrical competition. Mr. Brearley had spoken of ⅛d. for electricity for power purposes. At this price, gas at 1s. 6d. per 1000 cubic feet would be all right. Mr. Glover advocated differential rates for gas; and he (Mr. Wardell) quite agreed with him, especially in manufacturing centres where there was keen competition with electricity. In regard to quality governing or hit-and-miss governing, the former was slightly more efficient than the latter. The cyclic variation was greater in the case of hit-and-miss governing than in the case of quality governing. Mr. Andrews stated that he had several diagrams which were worse than those in the paper; but he (Mr. Wardell) had not taken extreme tests, but only average ones so as to be fair. Mr. Andrews carried out repairs as well as adjustments; and he (Mr. Wardell) thought the one thing would lead to the other. Certainly the price of 1s. 4d. was low.

Mr. ANDREWS: The 1s. 4d. only applies to very large engines—say, with a consumption of upwards of 1 million cubic feet per quarter. But 1s. 6d. applies to the small engines; the 1s. 4d. applies to cases of 1¼ million cubic feet per quarter. I have three consumers of this amount.

Mr. WARDELL (proceeding) said that Mr. Brearley had asked a question as to whether he had reversed the position of the test on calorific value. He had not done so. But he thought the same result would have been obtained. In test F, it would be noticed that the calorific value of the gas was 515 B.Th.U.; and the B.Th.U. per brake-horse-power-hour 11,850, as against 11,380 in test D, with a calorific value of 534. The proportion of gas and air was altered in the two cases. This was hardly the test that Mr. Brearley suggested; but it would be seen from the figures that the tendency of the tests would have been borne out if he had reversed them. In the tests to which Mr. Brearley referred (N and O) the gas consumption increased from 421 to 493 cubic feet, while the B.Th.U. per brake-horse-power-hour only increased about 10 per cent., which was not excessive.

HOLDER CONSTRUCTION.

SOME REFLECTIONS AND A SUGGESTION.

By A. F. YOUNG, of Bury St. Edmunds.

[A Paper read before the Eastern Counties Gas Managers' Association, April 24.]

Since the beginning of this year, the subject of gasholders has perhaps been discussed and written upon with a greater interest engendered than at any other time of the present generation.

In the busy life we, as gas managers, must now pursue, if we may hope to keep abreast of the ever-changing methods, both in the manufacture and distribution of gas, it seems we have almost made it an axiom that gasholder construction had reached such a state of perfection that nothing further was necessary. Also, the comparative rarity of the occasion that the rank and file of gas managers have such work on hand, makes the wise and cautious rather to submit to the guidance and experience of some of the various firms who have made a particular study of this branch of engineering.

The disaster to the gasholder at Ilkeston, however, adds another worry and anxiety to our profession. Certainly, it proves that a few £ *s. d.* should not be considered in allowing for perfect safety in such an important part of gas-works plant, the collapse of which might be fraught with such serious consequences, in maintaining an efficient supply, and be so much danger to the general public. On the other hand, I do not think there is any reason to be panic stricken, and to assume that steel tanks are unreliable or unsafe. There are plenty of steel tanks in all parts of the world to prove their safety and efficiency. I suppose a reason to account for this accident will never be given that will satisfy every inquirer or investigator. An "Engineer," writing what must be

confessed two very able articles in the "Gas World," has made it clear to his particular way of reasoning that the mischief commenced in the tank, being due to the brittleness of the plates. This is supported by Professor van Itersen, of Delft, in an article published in the "JOURNAL OF GAS LIGHTING;" and I know it is also accepted as the cause by at least one engineer who has large and extensive experience in such matters.

Against this theory, however, is the expert evidence given at the inquest; and this, it must be borne in mind, is given by engineers who have had the advantage of being on the premises, and seeing everything, just as it was left immediately after the accident. This evidence gives as the sequence of events: First, the locking of the outer lift by some cause unknown; next, the unsealing of the lifts due to the inner lift failing to supply the town with gas. As a result of this, the gas rapidly escaped, so making the inner lift come down in a quick descent, which quick descent set up such unusual strains upon the tank, sufficient to make the sides give way, and end in the manner stated.

May I here suggest that the true cause may be looked for in a combination of all the above-named circumstances. That the inner lift had run-down nearly its whole length is clear from the photographs produced, though an "Engineer" says it would do that even after it had been displaced from its original position in the tank. The calculations made by Mr. Bell show ample margin of safety in the thickness of the plates; nevertheless there must have been some inherent weakness to make them give way as they did. "Why," it has often been asked, "does an engine shaft, after running for many years without showing sign of fracture, suddenly break?" Why, too, does a tie-rod, after years of service, collapse without warning?—as instance the disaster at the Charing Cross Station. Also, on a frosty morning, a woodman or carpenter before using his axe will, if possible, take the cold chill off it, as he knows from experience that the steel is more liable to fracture when under the influence of frost. In the same way, railway platelayers know that unaccountable breakages take place on the permanent ways during a period of frost; and in cutting and breaking steel rails, the work is done much easier during the frost than under normal conditions.

It is assumed that in some mysterious manner there is a re-arrangement of the molecules under the influence of constant rotation, constant strain, and by excessive cold, which produces what may be best described as brittleness in the texture; and, for want of a better name, engineers speak of iron and steel under such conditions having what one of the patent medicine vendors terms "that tired feeling."

If, then, we remember that on the day of the accident there was a sharp frost, which would tend to produce brittleness, also there was a strong wind blowing, if there was any locking of the outer lift, and consequent rapid descent of the inner lift, it is easy to imagine the combination of these circumstances would produce results that neither one nor the other would cause alone.

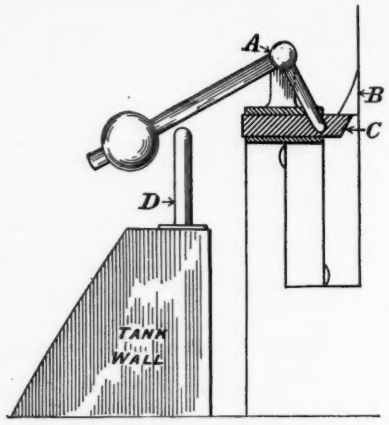
In the construction of spiral-guided gasholders, due allowances ought to be made in the mounting of guide pulleys for expansion and contraction, and all other causes entering into the free and perfect working of the various parts. This injunction seems to be too elementary even to require mentioning. Nevertheless, as one having had some considerable experience in practical engineering, I think this is sometimes neglected. From acquaintance with mechanics and fitting-shops, I know the pride with which turners and fitters turn out their work, so that the fit and run of the machine may be perfect. In most machinery and working parts, this is all to the good, and may be one of the reasons for the superiority of British-made machines generally. But here is the difficulty, to know the occasion (to discriminate) when a job should "fit like a glove," and when there ought to be a certain amount of play to ensure freedom of action under all circumstances.

Now in the case of rollers for spiral-guiding of gasholders, What harm would there be in boring them out so large that they might be slipped on to their respective spindles, even if the spindles had a piece of notepaper wrapped round them? Also what harm could be done if, when mounted, the rollers had ¼-inch end-play? This I contend is how this piece of work ought to be done, as there would be much less possibility of the rollers setting-fast with rust; and the end-play given would be of advantage to meet the expansion and contraction of the ring of the gasholder. This, however, on any I have examined, is not how they are turned out of the maker's works, but rather they are fitted with a precision and nicety that are never required; and hence arises half the trouble when we hear of rollers simply acting as slide-blocks instead of what they are designed for.

May I say I think the spiral-guided gasholder is right in theory, and, what is more to the practical man, is better in action than the ordinary holder. My experience confirms all others—that in strong winds they are more stable and less liable to damage than vertical-guided holders. If my remarks as to rollers were carried out, we should not hear so much of the bogey of the rollers needing so great an amount of attention as we have heard. During a heavy gale, I have watched vertical-guided holders swinging and swaying to such an extent as to make me feel very uneasy about their safety, while at their side a spiral holder stood as though it was a fixed steel structure. During this same time, the pressure-gauge of the ordinary holders showed considerable fluctuation, owing to their mounting and rearing as the wind struck them; while on the spiral holder the gauge was as steady as during the best of weather.

In addition to the strains set up by the wind in a spiral-guided holder, on account of the screw motion, it is easy to conceive conditions whereby there would be a certain torsional strain, as from the centre of tank, and though, on account of the tank not being a solid bar, this strain would result in tensile stress on the plates, still it is additional, and ought to be provided for when the tank is designed. If we assume the cause of the Ilkeston accident given in the expert evidence as correct, and also if it is admitted there is a possibility of, through any cause, an outer lift jambing, the question naturally arises, "Is there not a remedy?"

This brings me to the suggestion I have to make to-day, which is a revival of an idea I had five years ago. At that time, I had occasion to telescope a gasholder, and was thinking seriously of doing so by means of a flying lift; but, though it is contrary to what Mr. Cripps and other able men have written, I could not feel safe in doing so, as, there being much high-lying land on one side of the holder, I thought there was a possibility of the wind swooping down with such force as to tilt an unsupported lift sufficiently to unseal the cup. At that time, when thinking of these things, I thought "Why should not the cups of all holders be automatically locked after rising above the tank level?" Now after a lapse of five years, and the experience of the Ilkeston disaster, I make the suggestion for your criticism.



A. Bell Crank. B. Snug or Angle Ring. C. Sliding Plunger.
D. Bracket on Tank.

As you will see, I have prepared a small model gasholder to show how this can be put into execution. This arrangement is necessarily of the crudest type, as I could not hope to fit it with refinements necessary for practical working. But it is obvious all working parts, ends of levers, and such like, would require to be fitted with rollers to avoid unnecessary friction. The device here shown simply provides a set of plungers which fit under suitable snugs, or preferably an angle ring, carried round the holder, and fixed to vertical stays of an ordinary gasholder, or to rail plates of the spiral. These plungers are made to travel in and out by means of bell-cranks. When the holder is cupped, a balance-weight on the bell-crank would be all that was necessary to put the plungers into position, and so automatically lock the cups when they were in action. To release, suitable brackets fixed on the side of the tank would engage with bell-cranks, so that (say, while the lift to be disengaged was 6 inches from landing) the plungers would be extended, and so make the inner lift free to go down as usual. It is obvious that there are many modifications of this arrangement, which would serve equally well for the purpose.

The objections, I assume, would be the increase of cost necessary to provide these several mechanisms, and the additional amount of working parts needing attention. It might be also argued that if a holder was held up without any supporting gas-pressure inside, there would be a danger of the crown collapsing. This did not happen at Ilkeston, however, for after all the gas had gone the holder seems to have been perfect.

Discussion.

The PRESIDENT (Mr. Paternoster), inviting discussion, said they had had a very interesting paper from Mr. Young. He hoped the author's novel idea would lead to something useful.

Mr. SAMUEL GLOVER (St. Helens) said he was pleased to be present to hear this very interesting paper read. The writer had referred to the evidence given in connection with the Ilkeston disaster, and to the much unsolicited evidence that had since been given. He did not think he need warn members as to not being in too great a hurry to accept ideas that had been offered so freely, and in such an unsolicited manner. It was not because the advice was offered unsolicited, or anything of that sort, that he spoke a word of warning. If it had been useful (which a great deal of it was not), he should have been one of the first to have recommended the members to take advantage of it. Much of the evidence, however, that had been offered was by men who had never taken the trouble to visit the scene of the disaster. If any of the members wanted to learn more about it, and would take the trouble (and anything that was worth doing at all was

worth doing well) to visit Ilkeston, and see Mr. Humphrys, the Engineer and Manager there, he would personally explain, to any of their friends in the gas profession, the sequence of events, which he had more carefully ascertained than any other man. They would have to—notwithstanding what had been said about, and what was in some people's minds as to, the perfection of gas-holders—agree that the last word had not been uttered as to the construction of holders, and about the care that was necessary in properly proportioning them for the work they had to do. They had recently had a rather shocking reminder in another class of engineering, that it did not do to conclude that the last word had been said about such things. The conclusion that the author of the paper had arrived at, through only having seen the photograph of the holder at Ilkeston, was not quite correct. The inner lift would have gone still further down, but the outer lift was by that time so distorted that the inner lift could not get to its normal position in the outer lift, or it would have done so. The conclusion that their friend had come to—that gas-holder construction was almost perfection, and then his suggestion that the working parts were too nearly like those of an engine and had not sufficient play—were rather contradictory. However, he (Mr. Glover) did think it would be proved that the working parts of holders would need very careful attention; and he was quite certain they would receive better attention in the future. From the disaster at Ilkeston—if it was carefully looked at, and properly looked at, and the truth ascertained, as they were anxious to ascertain it—they would learn such lessons as would help them both with regard to spiral-guided and other holders. He did not quite understand what ground for fear their friend had that, if an inner lift of a holder was left without gas, the crown would sink in. This would only happen, he (Mr. Glover) took it where an exhauster was pulling and causing a partial vacuum in a holder; but the trussed roof would support the crown, as it had to do before any gas at all was put into it. The Ilkeston holder had a trussed roof; and therefore the crown did not go in. With regard to the locking of the cups of a gasholder, he hoped their friend's suggestion would receive careful consideration. He (Mr. Glover) was prepared to give it careful consideration, because it was certain that, when the cups of a gasholder did become unsealed (and it was within one's knowledge that many gasholder cups had become unsealed in some way or other), the inner lifts of holders mysteriously disappeared from sight; and possibly if some of these holders had been in steel tanks, and subject to the same circumstances as the Ilkeston holder, with the gas escaping with rapidity, something more might have been heard of such occurrences. It was known to many gas engineers that inner lifts of gasholders did mysteriously get unsealed and sometimes descend; and if this arrangement that Mr. Young had brought before them (which he understood was applicable to either spiral or vertically guided holders) would be of use to them, it would be welcomed. But they wanted to understand a little more about it before expressing any definite opinion.

Mr. W. D. Child (Romford) hoped the author would excuse him in disagreeing with him as to the fitting of the guiding arrangements—the pulleys and the spindles—of holders. He personally preferred that the work should be done in such a way that they only got a thin film of lubricating material between the pulleys and the spindles. He would rather have this than the slackness that would allow a sheet of letter paper to be inserted between the spindles and the pulleys, and which slackness would give accommodation for dirt. He thought it only right that, to keep a gasholder in order, it should have at least a weekly supervision—that a man should go round, and prove with his hand that every roller was in running order. He had had a spiral-guided holder in service for ten years; and he had never allowed such a reasonable precaution as this to be neglected. There were many instances of ordinary guide-framed holders that were so slack that the lifts would tumble about in all directions. But where a holder was expected to work up and down, and to maintain an even pressure, then accurate running up and down was an essential. He knew of vertically guided holders that swung about in heavy gales, while spiral-guided holders maintained a perfectly steady gauge; and he thought this was to be attributed to the better fitting that was usually put into all modern gasholders. It was the last thing they should ask the makers to do, to go from good practice to slovenly work.

A demonstration was here made by Mr. Young, by the aid of a model, with his arrangement for the automatic locking of the cups of holders on their ascent, and unlocking in the descent of the lifts.

Mr. Young, replying to the discussion, observed that Mr. Glover had very wisely said, and he (Mr. Young) thought he made the point in his paper, that it would be a good thing if one could see everything before one entered too rashly into discussion. He had made the point, by saying that the expert evidence was given by engineers who had been to Ilkeston, and had examined everything, and so could form some opinion as to what had happened better than a person theorizing some 100 miles away. Mr. Glover also said that the inner lift would have come down the whole way if the outer lift had not got distorted. This he supposed was so, as he understood the bottom of the holder was so bulged in that it stopped the inner lift from descending altogether. But, of course, this did not necessarily follow. It had been pointed out that, even if the holder had fallen out of position, the inner lift could have come down in the outer lift until it met the distortion, just the same as it would if it was floating in a tank. Then Mr. Glover had mentioned that the Ilkeston holder was a trussed one. In the case of wide trussed holders there might be some danger. While not necessarily going to the extent of putting an exhauster in to pull out the gas, the gas might escape until it found atmospheric pressure, and then the question would be, would the plates sag down, and so distort the crown until it met with a calamity this way? He was not personally in a position to say. Mr. Child had spoken of the accurate fitting of the rollers. This was a point upon which they had a right to their own opinions. Mr. Child preferred to have them fitted so as only to have a thin film of oil between the rollers and the spindles. He agreed with him that, if he could fit a thing this way, and have a film only of oil, it would be ideal. But he could assure them, from his practical experience in engineering, that in practice this was not always possible. They would find that, if a thing was fitted in too ideal a manner, when it was exposed to outside temperatures and influences, and rain and dirt got into it, they would stand a good chance of having the rollers locked fast, and acting only as slide-blocks. Mr. Child said that, if the rollers were too slack, dirt would accumulate in them. It all depended upon how slack one made them. There would not be any difficulty with the amount of slackness that he (Mr. Young) suggested. The rollers themselves would, with sufficient play, themselves clear away anything that was going in—by being able to work freely, and not getting set-fast as they too often saw them. Then Mr. Child advocated a weekly supervision. This was all very well for some of their advanced *confrères*. But some of them who had (say) 50 or 60 million works to look after knew of difficulties in this matter; and it was not so easy to get these things attended to every week as was imagined. He might cite a case in point of how a weekly inspection took place in a small works. He had a holder in which the cup got locked; and he had a man to look to it every day, to see that the cup was in order. One day he (Mr. Young) happened to be off ill. Through some cause the man in question got his leg broken; and he was taken to the hospital. But nobody thought to give instructions to anyone to look after the particular gasholder. The result was they found the holder going down, and the gas was wasted. He quite agreed that, if it could be done, it would be preferable; but it was not usually done.

Mr. Child: You prefer the thing to look after itself?

Mr. Young: There is a medium in everything. Continuing, he said as to spiral-guided holders standing firmer to the wind than the ordinary type, Mr. Child said that this was due to the better fitting. He (Mr. Young) did not see how it was so. They could make such holders quite slack—just as in the case of ordinary holders they could adjust the rollers to the guide-rails, so as to keep the holder taut and secure.

POSITION OF THE GAS INDUSTRY IN GERMANY.

Recent numbers of "La Technique Moderne" have contained a series of articles by Herr W. Bertelsmann, of Berlin, on the present state of the gas industry in Germany. The object of the articles is to give French technical men a general idea of the conditions of the gas industry in Germany at the time, and naturally many points of interest are presented in a way which appeals equally to English technical men.

The author points out that about 5 million tons of German coal are used in the gas-works of Germany annually—that is to say, about 3·4 per cent. of the total coal output of the country. In addition, about 2 million tons of English coal are carbonized in German gas-works, corresponding with about 20 per cent. of the English coal imported into Germany. In comparative figures of the composition of the different classes of coal, and of the yields of gas and the bye-products from them, the author credits both Silesian and Westphalian coal with a higher average make of gas than English coal. The plant used on gas-works in Germany is described by the author mainly with reference to that at the Tegel works of the Berlin Corporation, and illustrations are given of the more important items of the plant required upon a large gas-works. The advantages of the storage of coal in large store-houses divided into sections, and with a basement in which the coal is drawn off into conveyors for transmission to the retort-houses, are emphasized by reference to the large coal store-house at Tegel. In regard to water-gas manufacture, the author states that 75,000 tons of coke are now used annually in water-gas plant in Germany, which represents about 1½ per cent. of the coke made in the country. The greater part of the oil used in carburetting the water gas is imported from Galicia; and a relatively small import duty is exacted on the grades of oil employed for the purpose. The amount of oil used in carburetting water gas is stated at approximately 20,000 tons. The carburetting of water gas in the cold by means of benzol, which was formerly much in vogue in Germany, is stated to be falling into desuetude.

The author refers to the increase in the heats of carbonization in recent years, with the consequent production of a relatively poorer, but cheaper, gas. He points out that in Germany the tendency has been to displace the old types of retort-settings by settings of vertical retorts, &c.; whereas in England, he says, the gas industry has reduced the cost of manufacture as much as possible mainly by the extended employment of stoking machinery

in conjunction with horizontal retorts. He refers to the former extensive use of inclined retorts in Germany. At the close of 1911, there were about 11,000 of these retorts in the country, and about 34 per cent. of the total make of gas was produced in them. But in 1909, 2983 vertical retorts had been installed in Germany, and 12 per cent. of the total make of gas was produced in them. At the same time, large carbonizing chambers or ovens were being introduced; and in 1910 there were 271 of these chambers in use, making about 2 per cent. of the total production of gas in the country. Of these chambers, 227 were of the Munich type, as devised by Herr Ries. Illustrations are given of installations of these chambers at Tegel, and of the Klönne inclined chambers at Königsberg.

In Germany, the gas passes from the retorts usually into the hydraulic mains, and only in the case of coke-ovens, or similar plant, into collecting mains without a liquid seal. Atmospheric condensers followed by hydraulic condensers are in general use; and the cooling surface allowed is commonly 2·3 square feet of atmospheric condenser, and 2·3 to 3·8 square feet of hydraulic condenser, per 1000 cubic feet of gas per 24 hours. Beale exhausters have hitherto been commonly preferred to reciprocating exhausters; and recently Rateau blowers, in conjunction with Laval turbines, or Roots blowers have been introduced in some works. Tar extraction is usually effected in Germany by means of the Pelouze and Audouin apparatus. The wet process of extraction of cyanogen by means of ferrous sulphate is usual, and the absorption of cyanogen as sulpho-cyanide is not adopted in Germany. The production of concentrated liquor containing 10 to 25 per cent. of ammonia is very general in Germany in place of the manufacture of sulphate. Purification is generally effected by means of bog oxide obtained from the North of Germany or Holland, or by Lux purifying material, which is produced from bauxite. When cyanogen extraction is not carried out in the wet way, the oxide has a considerable value as a source of Prussian blue. But the cyanogen works do not care to buy spent oxide containing less than 8 per cent. of Prussian blue; and the value of spent oxide to sulphuric acid works is not great. Different systems of construction of gasholder tanks are described by the author. Some interesting analyses of the composition of coal gas, mixed gas, and simple and carburetted water gas, as produced in different towns in Germany, are given. Reference is also made to the great increase in recent years in the distribution of gas to places at a considerable distance from the works.

In regard to the gas industry in Germany, the author reports that there were, in 1909, 1474 authorized public gas undertakings in the country, of which 88·87 per cent. made coal gas or mixed gas, and the remainder acetylene, air gas, oil gas, or water gas. The total make of the 1310 works producing coal gas and mixed gas amounted in the year to 72,915 million cubic feet. The capital invested in gas-works in the country was approximately £75,000,000. Nearly 71 per cent. of the works were owned by municipalities. Over half of the gas produced is consumed for cooking and heating purposes. The workmen employed in the German gas-works number 56,000; and the staffs comprise 5000 officials. A large number of industries are dependent on the gas industry. For instance, there are in Germany 54 works concerned solely, or mainly, with the construction of gas-works; 158 factories manufacturing heating appliances; 338 firms making lighting burners and similar apparatus; and 141 works making mantles.

Dr. Houston's Research Work in Water Examination.

We have received from the Clerk to the Metropolitan Water Board (Mr. A. B. Pilling) a copy of the seventh report on the research work carried out by Dr. A. C. Houston, the Director of Water Examination. It is a valuable addition to the series, and furnishes evidence of the thoroughness of the investigations of which it embodies the results. In an introduction, Dr. Houston makes some general observations on the six sections into which his report is divided, and then gives them in succession. The subjects dealt with are: (1) Search for Pathogenic Microbes in Raw River Water; (2) Comparative Vitality of "Cultivated" and "Uncultivated" Typhoid Bacilli in Artificially Infected Samples of Raw River Water; (3) Comparative Vitality of the Typhoid Bacillus in Raw Thames Water at Different Temperatures; (4) The Biological Characters of the *Bacillus Coli* Isolated from Raw River Water, Stored Water, and Stored and Filtered Water; (5) Advantages of Passing Raw River Water through Small Reservoirs Antecedent to Storage in Large Reservoirs; (6) Advantages of Occasionally Using Precipitation Methods Antecedent to the Storage of Water in Large Reservoirs. The report, with the appended tables, occupies about 80 foolscap pages; and Dr. Houston considers that, on the whole, it is a hopeful one. In particular, he says "it affords evidence in favour of the relatively non-infectious qualities of the raw sources of supply, and shows that uncultivated typhoid bacilli perish much more rapidly in river water than their cultivated brethren. It indicates the importance of adequate storage, and not the inutility of storage under low-temperature conditions; it shows the advantages of pre-storage settlement; and it suggests that the occasional employment of supplementary processes of purification is a matter worthy of future consideration."

Heavy Oil-Engines.—A course of four lectures on this subject, under the Howard Bequest, was commenced at the Society of Arts last night by Captain H. Riall Sankey, R.E., M.Inst.C.E.

COMPOSITION OF GAS TARS.

A paper which was read by Dr. P. Schläpfer at the last meeting of the Swiss Association of Gas and Water Engineers [see "JOURNAL," *ante*, p. 230], contained much valuable information on the composition and properties of gas tar as produced in various Swiss gas-works, especially with reference to its applicability as fuel for Diesel engines. For comparative purposes, the information conveyed in the paper is likely to be of use to producers and users of tar in other countries; and we therefore give the following summary of the contents of the paper.

The author observes that, whereas the dependence of the composition of the gas on the nature of the raw material and the method of working has been fairly thoroughly traced in connection with the carbonization of coal on gas-works, comparatively little work has been done to show the relation between the character and composition of the tar and the nature of the coal and its method of carbonization. Tar has been exhaustively studied from the point of view of the isolation of ingredients of definite composition chemically; but there are comparatively few investigations of the physical and chemical properties of the tar as such. The elementary composition, the calorific power, and the physical properties of the tar have a definite relationship with the raw material from which the tar is produced; but the quantity and nature of the tar from a particular fuel also depend on the conditions of carbonization. It has been shown that the yield of tar increases as the oxygen contained in gas coals undergoing distillation is higher. Wood generally yields an acid tar rich in oxygen; brown coal or lignite, a tar containing much hydrogen and fatty hydrocarbons; while bituminous coal yields tar in rich carbon. Börnstein published in 1906 a study of the decomposition of solid fuels at slowly increasing temperatures [see "JOURNAL," Vol. XCV., p. 836]. He subjected fuels, ranging from peat to anthracite in character, to dry distillation in a small experimental apparatus; but he did not use a temperature above 450° C. (842° Fahr.), which is not high enough for complete carbonization. His experiments proved that in chemical and physical properties the raw material and the tar were correlated; the nature of the fuel being reflected in the tar. Coal which is poor in oxygen never produces tar rich in oxygen. It was also shown by Börnstein that in his experimental conditions bituminous coal produced a tar which was a clear brown oil having a specific gravity between ·95 and 1·03, and completely void of free carbon and naphthalene. It contained 7·8 to 9·0 per cent. of hydrogen. It is evident that, in conditions which prevent the decomposition of the hydrocarbons a thin, light, oil-like tar can be obtained technically. This is shown by the tars produced in vertical retorts. Dr. Constam, working in conjunction with Dr. Kolbe and Dr. Schläpfer ["JOURNAL," Vol. XCVI., p. 460; Vol. CIII., p. 382; Vol. CVII., p. 696], has carbonized coals from different sources at a temperature of 820° C. (1508° Fahr.). The tars produced resembled horizontal retort tars, but a general relationship between the coal carbonized and the tar was indicated.

In the gas industry only certain descriptions of coal are carbonized, and at high temperatures. Since the tars from horizontal, inclined, and vertical retorts, and large carbonizing chambers, are quite different in their properties, the cause of the difference must evidently primarily lie in the type of setting. Hitherto coal tars have for the most part gone to distilleries, and their examination has been directed to ascertaining their suitability for distillation. The examination has comprised the determination of specific gravity, free carbon, and water, and a fractionation in which the products have been separated into different groups going by the names of light oil, middle oil, heavy oil, anthracene oil, and pitch. But recently coal tar has been used to a considerable extent for heating purposes, and certain descriptions have been used as fuel for Diesel engines. For these purposes, the tar must be judged from a different standpoint—the calorific power and the ultimate composition become important. A large number of gas tars produced in Switzerland have been examined at the Federal Fuel Testing Laboratory at Zürich; and the results for twenty-nine different coal-gas and water-gas tars are presented in a table. A selection from these results is given in the annexed table. The examination of the tars included determinations of specific gravity, flash-point, temperature of ignition, consistency when cooled, water, ash, gross and net calorific power, ultimate composition, yield of coke, free carbon, and naphthalene. A fractionation was also made. The figures have been referred for comparative purposes to the true tar substance, or dehydrated and ash-free tar. The tars examined were average samples from the tar-wells of the gas-works, except in the case of tars especially collected from the hydraulic main and different points in the condensing plant. The horizontal and inclined retort tars are black; the vertical retort tars, brown and freely fluid. Generally, the chemical and physical properties of inclined retort tar lie between those of horizontal and vertical retort tars.

In regard to physical properties, the horizontal retort tars have the highest specific gravity, and the vertical retort tars the lowest, that of the latter varying in different consignments from different works only between 1·08 and 1·09. The different tars do not show considerable variations in the flash-point and temperature of ignition. Horizontal retort tars stiffen on cooling much more rapidly than others. Fractionation discloses considerable differences; the yield of oils, and light and middle oils in particular, being highest with vertical retort tars. The residue of pitch obtained

Properties and Composition of Different Swiss Gas Tars, and Some Fuel Oils.

Description and Origin of the Tar or Oil.	Specific Gravity at 59° Fahr.	Consistency at 32° Fahr.	Water. Per Cent. of Crude Material.	Ash. Per Cent. of Crude Material.	Calculated on the Dehydrated and Ash-Free Material.										
					Light Oil (to 170° C.	Pitch or Residue (at 350° C.)	Free Carbon.	Naphthalene.	Yield of Coke.	Ultimate Analysis.				Calorific Power.	
										Carbon.	Hydrogen.	Oxygen Nitrogen.	Sulphur.	B.Th.U. Per lb.	B.Th.U. Per lb.
					Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Gross.	Net.
HORIZONTAL RETORT TARS.															
From Saar coal—															
Lucerne gas-works	1·181	Still Fluid	8·72	0·06	3·8	63·8	24·6	5·8	31·4	92·9	4·9	1·7	0·5	16,493	15,872
Hydraulic main—															
Bâle gas-works	1·205	Solid	5·52	0·00	1·6	67·2	20·7	1·3	25·0	92·6	5·1	1·8	0·5	16,477	15,926
INCLINED RETORT TARS.															
20-ft. retorts—															
St. Gall gas-works	1·132	Barely fluid	3·44	0·37	6·7	51·4	12·6	2·0	18·8	90·2	5 9	3·4	0·5	16,452	15,790
Zürich gas-works	1·146	Solid separating	7·02	0·07	2·7	54 1	19·3	1·7	24·4	90·4	5·9	3·2	0·5	16,528	15,860
VERTICAL RETORT TARS—INTERMITTENT.															
From English coal—															
Berne gas-works	1·089	Highly viscous	2 25	0·03	4·3	40·2	1·7	0·6	8·8	88·8	6·8	3·8	0·6	16,648	15,979
From Ruhr coal—															
Zürich gas works	1·087	Solid separating	2·32	0 00	4·1	44·3	3·6	0·2	8·0	88·0	6·8	4 7	0·5	16,664	15,986
VERTICAL RETORT TAR—CONTINUOUS.															
Lausanne gas-works	1·090	Viscous	2·34	Trace	8·4	44·0	3·1	0·2	13·5	87·9	6·8	4·4	0·9	16,632	15,912
WATER-GAS TARS.															
From Galician oil—															
St. Gall gas-works	1·119	Sets	1·18	0·00	4·1	51·3	2·0	8·1	11·4	93·0	5 5	0·7	0·8	17,015	16,478
Bâle gas-works	1·061	Fluid at − 6° F.	2·51	0·28	4·3	37·5	0·8	0·6	11·1	91·7	6·9	0·6	0·8	17,471	16,740
Geneva gas-works	1·087	Solid separating	13·38	0·36	2·3	45·2	2·3	0·3	10·6	91 6	6·3	1·2	0·9	17,185	16,177
Lausanne gas-works	0·968	,, ,,	0·20	0·00	1·5	18·6	Trace	0·4	3·9	89·3	9·2	0·8	0·7	18,180	17,271
OIL-GAS TAR.															
From heavy Galician oil—															
Swiss railways	1·069	Viscous at − 6° F.	10·31	Trace	23·1	37·2	4·1	3·1	15·2	92·2	6·3	1·1	0·4	17,158	16,355
COAL TAR OILS.															
From German works	1·062	Becoming viscous at 14° F.	0·38	0·04	..	2·0*	0·01	..	2·9	88·9	6·9	3·8	0·4	16,940	16,261
,, French ,,	1·071	Viscous at − 6° F.	1·82	0·03	..	2·5*	0·11	..	2·3	91·4	6·7	1·4	0·5	17,111	16,447
SCOTCH CRUDE SHALE OIL	0·942	Sets at 12° F.	Trace	Trace	..	0·6*	0·00	..	0·9	86·4	9·9	3·1	0 6	17,894	16,936
GALICIAN PETROLEUM GAS-OIL	0·869	Fluid at 32° F.	0·00	0 00	..	1·0*	0·00	..	0·2	86·4	12·7	0·5	0·4	19,460	18,223

* Residue above 400° C.

from the latter is of different composition to that from horizontal and inclined retort tars. It contains much more bitumen or soluble constituents, and yields less coke—viz., 19 to 25 per cent. These qualities are closely dependent on the amount of free carbon in the tar, which is highest in horizontal retort tars, reaching a maximum of 25 per cent. in the samples examined, and does not fall below 10 per cent. with inclined retort tars; whereas with vertical retort tars it is from 1 to 4 per cent. The amount of water and the variations in its amount in different consignments are greater with horizontal retort tars. The proportion of ash is small with all the tars. The impurity which would most affect the calorific power of the tar and its suitability for use in Diesel engines is the water. The calorific power of tar of the same origin does not vary more than 540 B.Th.U. net per lb. of dehydrated tar. The calorific power is highest with the vertical retort tars; being 15,840 to 16,380 B.Th.U. net per lb., and 16,560 to 17,000 gross per lb. In regard to ultimate composition, the horizontal retort tars are the richest in carbon and the poorest in hydrogen and oxygen; while the vertical retort tars contain the most hydrogen. The amount of sulphur is fairly constant, and scarcely ever exceeds 1 per cent. The naphthalene changes with the free carbon, rising to 5·8 per cent. with horizontal retort tars, ranging from 1·7 to 2·0 per cent. in inclined retort tars, and falling to 0·2 to 0·6 per cent. in vertical retort tars. These results indicate that the products from vertical retorts have not suffered such extensive secondary decomposition as those from the other types of retorts. But as the naphthalene does not advance in the same ratio with the free carbon, it must be concluded that there is a filtration of the products of carbonization taking place in vertical retorts. Generally speaking, Swiss gas tars are not inferior to those produced in other countries.

The tars produced in the carburetting of water gas differ considerably in physical and chemical properties, the specific gravity ranging in the samples examined from 0·98 to 1·13; proportion of hydrogen from 5·5 per cent. to 9·2 per cent.; gross calorific power from 16,920 to 18,180 B.Th.U. per lb.; proportion of naphthalene from 0·3 to 10 per cent., and the proportion of free carbon from 0 per cent. to 4 per cent., although the oil used was in all cases Galician gas oil. The considerable differences can only be explained by differences in the method of working the carburetting plant; and the resultant gas must have similarly varied in composition. It was found that water-gas tar from the same gas-works varied considerably in composition—for instance, the naphthalene in the water-gas tar from the St. Gall works ranged from 0·4 to 10 per cent. Notwithstanding the high proportion of naphthalene, the free carbon only amounts at most to 4 per cent. This supports the view that in horizontal and inclined retorts the free carbon found in the tar is partially derived from fine carbon carried off from the coal, and only partially from decomposition of the products. Allner has pointed out ["JOURNAL," Vol. CXV., p. 106] that vertical retort tars may be directly used in Diesel engines. But as the development of the Diesel engine may not yet be considered complete, there is a prospect that ultimately it may be made suitable for the consumption of horizontal and inclined retort tars.

The oils used for Diesel engines until a short time ago were exclusively petroleum and shale oils, which were specifically lighter than water, distilled almost without residue, had a gross calorific power exceeding 18,000 B.Th.U. per lb., contained more than 10 per cent. of hydrogen, and were free from suspended solid constituents. On account of the ease with which they ignited, they were regarded as the proper fuel for Diesel engines. Recently heavy coal tar oils have also been used. They comprise about 30 per cent. of the original tar, are heavier than water, and generally distil almost without residue. Their calorific power is about equal to that of the tar. They contain much less hydrogen than the gas oils, and ignite less readily. Oils therefore are added to them when they are used in Diesel engines. Since vertical retort, water gas, and oil gas tars approximate in their properties to the coal tar oils, it appears clear that these tars might be directly used in Diesel engines. Particulars of the properties and composition of a few selected samples of tar oils and other oils used in Diesel engines are given in the table. For the present, the high proportion of solid constituents in horizontal and inclined retort tars precludes their use directly as fuel for such engines. The most important criteria of fuel for the purpose are the calorific power, the content of hydrogen, the yield of coke, and the free carbon.

Herr Weiss, of Zürich, the Chairman at the meeting at which the paper was read, in thanking Dr. Schläpfer for his communication, observed that he followed the subject with great interest, because at the present time 80 per cent. of the tar produced in Switzerland was exported, and the derivatives of the tar when they returned to the country paid a heavy import duty. The use of tar and tar oils in Diesel engines would be of great value to the gas industry.

Dr. Bone's American Lecture.—In response to special request, Dr. W. A. Bone has undertaken to repeat his American lecture on "Surface Combustion" under the auspices of the Leeds University Cavendish Society, in the University Hall, on Tuesday, May 7, at 8 p.m. The lecture will be followed by an experimental demonstration. As there are a few tickets still undisposed of, Dr. Bone authorizes us to say that if any "JOURNAL" readers wish to attend, and will send their names and addresses to Mr. Herbert Wood, B.Sc., the Hon. Secretary of the Cavendish Society, Leeds University, on or before next Saturday, tickets will be forwarded to them as far as the seating accommodation of the hall will permit. Such tickets as may be available by the courtesy of the Cavendish Society will be allotted in order of the applications for them; and those who apply are requested to mention the name of the "JOURNAL."

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

Annual Meeting in Glasgow.

The Twenty-Ninth Annual "Informal Meeting" of Scottish Gas Managers was held in the Grand Hotel, Charing Cross, Glasgow, last Friday. Mr. JAMES M'LEOD, of Greenock, presided over a large gathering.

The CONVENER (Mr. W. B. M'Lusky, of Halifax) thanked the Chairman for his kindness in relieving him of the trouble of convening the meeting, and for making such excellent arrangements. He had had 86 replies, which was a record.

PRESIDENT'S ADDRESS.

The PRESIDENT then delivered the following address

THE COAL STRIKE.

Not in the history of the "Informal Meeting" has there been a meeting overshadowed to the same extent by a paralysis of industry so unheard of, so far reaching, and so overwhelming in its effects. Yet, overwhelming as the effects have been, how extraordinarily short they were of what the leaders of this unfortunate and regrettable coal miners' strike seem to have expected. In fact, one of Sam Weller's sayings, which you may remember, was: "I wonder if it was worth while going through so much to learn so little, as the little boy said when he came to the end of the alphabet." And this seems to me true of the miners and their leaders. The gas industry has reason to congratulate itself on the way it came through the ordeal. One may be allowed to express the pious hope that public opinion will ultimately drive the strike out of existence, as being a sheer method and relic of barbarism.

SCOTLAND AND VERTICAL RETORTS.

There are several aspects of our profession particularly prominent at present—such as the vertical retort as compared with the horizontal retort used under certain fairly well-defined conditions. The judgment in Scotland seems to be in favour of the former, although the only really working installation here at present is that at Helensburgh. The 5 million cubic feet per day vertical installation at Glasgow, however, is now practically complete; and the installations at Dunfermline, Johnstone, and Cambuslang have passed the preliminary stages. Scotland thus appears as a convert to the vertical principle; and this is only appropriate, when one considers the Scottish shale-oil industry, and the brilliant and resourceful men who saved this industry from annihilation, and that Scottish gas managers had thus at their very doors the vertical principle in full operation for many years back. Things which are seen daily are sometimes unseen by the inner consciousness; and this must have been the case with Scottish gas managers and the vertical retort. Several well-known investigators worked on the vertical principle in England; but the precedence in showing gas-making verticals as a commercial success falls, I think, to the German chemist Dr. Bueb, of Dessau. I was interested lately to find that one of my predecessors at Greenock (Mr. Samuel Stewart, a Past-President of the Institution of Gas Engineers) reported to his Committee on vertical retorts about 25 years ago, and mentioned, in his Presidential Address to the North British Association in 1890, that inclines were not likely to displace horizontals, but that verticals were.

The meetings of the various Gas Associations this summer should provide much information of a definite character about the working of vertical retorts; for at the Institution meeting last year the papers seemed a bit "cataloguey" in character. Careful study of the published results of vertical-retort working should enable us to form a sound judgment on the question whether the greater capital cost of the vertical is wiped out by the results obtained; and while in my own case I am fully convinced that verticals would pay me splendidly—and, indeed, I recommended my Committee to adopt them—one cannot overlook the fact that certain of the ablest men in the industry are approaching the matter with great caution. The first cost of verticals is very likely to decrease, which will, of course, alter the position materially.

CONDENSATION PROBLEMS.

Condensation has received much attention for some time back, and some widely divergent views are held as to the best methods of its accomplishment—indeed, this problem wants a good deal of skilled investigation and clearing up. It surely cannot be equally correct and equally advantageous to (1) cool the gas rapidly in one vessel to the temperature you wish to bring it to; and (2) cool it slowly in a slow-condensing main and slowly bring it to the desired temperature in a series of condensers. These views are apparently diametrically opposed; yet they are held by prominent men.

In attempting to arrive at a clear answer to any problem, the first step is to thoroughly understand the problem; and in order to properly grasp this condensation problem, it must be clearly stated. In all probability, Bowditch's forty-year-old definition covers the ground pretty well—viz.: "The proper object of condensation is the removal from gas of substances produced in the distillation which for some reason are not useful for the purpose of illumination, and the retention in the gas of all the substances which are useful as illuminants and can be distributed with the gas." The last phrase of the above definition is particularly good, because while naphthalene must be classed with the illuminants, it has a very irritating and troublesome habit of absolutely refusing occasionally to be "distributed with the gas."

The term condensation, as applied to coal-gas manufacture, means then that after the gas leaves the foul main it must be cooled to such a temperature that it will deposit the maximum amount of condensable matters, such as tar, together with naphthalene, steam (dissolving to some extent as it condenses CO_2 NH_3 H_2S HCy, &c.). At the same time, the illuminating hydrocarbons must be retained as far as possible; and these hydrocarbons, it must not be entirely forgotten, have heat value as well as illuminating value. But you may say: "Why bother about the illuminating hydrocarbons?" Why, indeed? But where the illuminating power is still independently tested, you are practically bound to, unless one can prove that these hydrocarbons are present in modern coal gas in such proportion that slow or rapid condensation may have but little effect on them. This effect may be non-existent, as the illuminating hydrocarbons content has dropped from 6·5 per cent. (when I tested it at the Dalmarnock Gas-Works twenty years ago) to about 4 per cent. in gas made at Greenock now. Last traces are proverbially difficult to remove; and it may be possible that the remaining 4 per cent. can stand much more drastic treatment than could a larger percentage without being reduced in amount.

You may say: "What is your own condensation practice, and then we know the faith that is in you." Well, the method used at Greenock is a 24-inch steel condensing main, about 900 feet long, fixed inside the retort-house. After leaving this, the gas is brought down to 60° by the water-tube condensers. The slow condensing main was in the works when the author came to them; the water-tube condensers are new, and were completed and put into operation last September. They consist of four units, containing 342 tubes each, of Clapham's "Eclipse" reversible water-tube type. They are nominally in two sets of 2 million cubic feet capacity per twenty-four hours; but they can be used as single units or in series in almost any order. The water can also be reversed and made to flow in at the bottom of any condenser unit. The water-flow can, however, only be reversed to the gas flow in any unit, as the gas inlets are all at the top, and the water inlets at the bottom, of the condensers. The temperature of the gas can thus be brought slowly or rapidly down, according to whether you introduce the cold water into the unit which the warm gas enters or into that from which the gas leaves.

The average temperature of the gas entering these condensers since they were started is 116° Fahr.—maximum 146°, minimum 82°. The average temperature leaving is 59° Fahr. The water used, measured through a Glenfield and Kennedy meter, was 641,900 gallons; the gas passed was 189,393,000 cubic feet. This gives 3·39 gallons per 1000 cubic feet to reduce from an average of 116° Fahr. to an average of 59° Fahr. The average temperature of the cooling water entering the condenser was 48·5° Fahr., and the average temperature of the outlet water 101° Fahr.

The enormous discrepancy that exists in the figures given by various makers as to the efficiency of their condensers, measured by the amount of cooling water required, is very remarkable. The following are some of the figures I obtained when taking offers for these new condensers. I am not able to give the water figure, except in the type I selected, which, as stated above, required, from September to March, 3·39 gallons per 1000 cubic feet to reduce from 116° Fahr. average inlet temperature to 59° Fahr. average outlet temperature. The figures for the other types were unfortunately destroyed.

Duplicate Set of Condensers—2 Million Cubic Feet Capacity per Day each Set.

No.	Price.	Water Tube Surface.	Air Surface.	Cooling Water Required Per 1000 Cubic Feet	Cost per Square Foot of Water Surface.
	£	Square Feet	Square Feet.	Gallons.	s.
1	1780	11,400	1130	..	3·12
2	2188	11,400	1696	3·39	3·80
3	1638	9,754	1300	..	3·36
4	1590	9,840	1024	..	3·23
5	1997	9,050	1240	..	4·41
6	2145	10,000	1163	..	4·29
7	1699	10,102	1578	..	3·36
8	1497	8,960	1152	..	3·36
9	2929	14,356	1840	..	4·11
10	2000	9,800	1536	..	4·08
11	1870	11,280	1870	..	3·31

Where town water is to be used, the economy of getting large condensers is obvious, and the difference of capital outlay is not in proportion. The objection to water-tube condensers is due in some cases to the amount of water required. Connection was made to the Firth of Clyde, so that water could be pumped if necessary; but the quantity of town water required was so small that the Firth supply has never been used. I was, of course, not anxious to use the water from the Firth, on account of its

saline content, and consequently greater corrosive action on the tubes than the excellent town water supply.

The water supply is easily controlled by Glenfield and Kennedy valves, and the outlet temperature can be regulated with ease. During the severe frost no water was run in, as the temperature of the gas at the outlet was satisfactory. No trouble whatever was experienced with freezing of water. Presumably the temperature of the condensers themselves prevented the inlet water pipe, which rises in the space between the two sets, from freezing. The temperature of the gas of about 60° Fahr. leaving the condensers means that, after the gain in temperature by passing through the exhauster is dissipated to some extent by the scrubber (the latter being in the author's case very close up to the exhauster), the temperature of the gas drops very considerably during cold weather, and requires to be raised somewhat before entering the purifiers to ensure a good reaction. The old 15-inch main, which till now has carried the gas from the scrubbers to the purifiers, was exposed for about 30 feet, being carried above a tar-well; and this facilitated the necessary heating of the gas. It did not suit the writer to blow steam direct into the gas, so about 12 feet of the 15-inch main was encased in 4½-inch fire-brick work, with fire-clay covers on top forming a rectangular box, and floored with 4½-inch fire-brick. A ½-inch steam-pipe was entered into this chamber at one end, and a ¼-inch opening was left for drainage at the other.

It was found that this very simple contrivance was amply sufficient to maintain the gas entering the purifiers at about 60° to 62° Fahr. with ease and certainty—the shift foreman simply looking at the thermometer now and again, and turning on a little less or a little more steam as required. The extreme ease with which this temperature was maintained within a narrow range raises the following point: Constant illuminating power, constant calorific value, and constant specific gravity have all been advocated, yet none of these can be constant if temperature is not constant. Constant temperature could easily be maintained and with trifling expense, so far at least as the bringing-up of the temperature to 60° is concerned (the bringing down is a different matter); but the proportion of the gas output to be brought down to 60° could not be large in our climate. The expense of maintaining this constant temperature would be merely the cost of boxing in a sufficient length of town main near, or in, the works, and inserting a suitable thermostatic control valve (say, of Reicherts or other suitable type), controlling a steam-valve or controlling the gas supply to a circulator placed somewhere near the main.

The temperature of the gas would not vary largely in the main itself once it was brought to (say) 60°. That this is so was shown by a temperature record taken during the first ten days of January, which gave an average temperature during the whole period of 45·4°. At the centre of the town, two miles away, the temperature, taken by a similar recording thermometer, was 44°—showing but little difference. Unfortunately, the thermometer met with an accident at the works; and as it had to go to America for repair, further tests were abandoned on the gas as it left the works. The record at the centre of the town, however, shows an average of 47° from Jan. 1 to March 31. It will be admitted that illuminating power, calorific value, and specific gravity, as measured and corrected to 60°, do not exactly apply to a gas measured at 47°. Of course, the case at Greenock may be an extreme one, as a length of 27 feet of the 24-inch town main is exposed on the side of a bridge as it leaves the works, and the gas is thus severely chilled in winter time. It is contemplated, however, that the ditch bridged over may be filled in. This filling in of the ditch would enable the boxing of the main to be easily carried out, and the regular temperature maintained.

To sum up, the possible advantages if this constant temperature could be maintained are as follows: A decreased amount of gas unaccounted for, the more regular working of gas appliances, and the possible decrease in the amount of naphthalene deposited, for it should be remembered that tar down to a certain temperature is increasingly capable of dissolving naphthalene. Pannertz, of Crefeld, recently published results showing the maximum absorption point of anthracene oil towards naphthalene to be 62·6° to 64° Fahr.; and coal tar will probably act in a similar way. While Pannertz's results are as shown, the investigations of the Michigan Gas Association Fellowship are just as direct in favour of the view that the tar absorbs more and more naphthalene at higher temperature. Gas, on the other hand, retains more naphthalene at the higher temperatures. Consequently, if the gas were kept at about 60° Fahr., more naphthalene would be kept in suspension or solution in the gas. Thus at 50° Fahr. only 7 grains of naphthalene per 100 cubic feet will be carried; while at 60° double this quantity could easily be carried by the gas.

UNACCOUNTED-FOR GAS.

So much has been said and written about unaccounted-for gas that there can be nothing of moment left for me to say; but I might be pardoned for touching on some of the causes of unaccounted-for gas, for the subject is an ever-interesting one. The first point is the faulty station-meter, which may run (say) 2 or 3 per cent. fast, or even more, and, consequently, leakages, stated at 1 or 2 per cent., unless the station-meter is tested every half year at the least and allowance made for same on gas made and registered, are absurd. Further, one might ask: Is the station-meter likely to maintain the same rate of error when passing 70,000 cubic feet per hour when passing 30,000 cubic feet per hour?

Passing over gasholders as a possible source of loss, as these are in most instances well looked after, one comes to mains and services. But on this vast subject I shall say nothing beyond that more and more attention is being devoted to this branch as time goes on, and a definite scheme for the more complete training of the gas-fitter is now completed and ready to be put into operation. From this much may be hoped for.

The difference between the volume of the gas as corrected to 60° at the works and the volume at the temperature of the consumer's meter is a serious cause of unaccounted-for gas. In the writer's case, this might amount to approximately 2½ per cent., with an average temperature in the main at the centre of the town of about 50°, as compared with the corrected temperature of 60° at the works. The writer, in order to gain some information on this point, purchased two recording thermometers; and after running them for several weeks against standard thermometers, inserted one in the 24-inch main on the other side of the bridge leaving the works, and placed the other 2 miles away in the centre of the supply area. Unfortunately, both thermometers went out of action—in one case due to some slight accident in erection, while the other failed to correspond with the standard instrument at the end of the experiment. However, enough indication was given that if the writer applied a correction of 10° to the volume of gas indicated by the station-meter, and corrected to 60°, it would be absolutely fair and legitimate. The average distribution temperature of 50°, as compared with the registration temperature of 60°, seems approximately correct for the district. If the holder storage is large, then in time of severe frost there will be all the more chance of the gas leaving the works at a very low temperature; and, of course, the lowest temperatures are practically coincident with maximum outputs.

Faulty consumers' meters form a serious cause of unaccounted-for gas, especially with a large proportion of wet meters in a high district. How much error may be introduced by wet meters in high districts may be gauged from the fact that in one district examined 91 meters tested showed the following figures—viz., 59 working at very low water level, varying from 3 to 12 gills of water short; 21 required from 1 to 2 gills of water to bring them to true water line; and 11 were correct. In other words, 80 meters in one district were raising the amount of unaccounted-for gas. The dry meter has the very distinct advantage of requiring less personal attention than the wet meter, and consequently wets are being replaced as rapidly as is financially possible in Greenock. There are, however, still 5154 wets, against 11,200 ordinaries and slots. Condensation of certain constituents of the gas, and consequent loss of volume, in the main is also a source of loss, but need not be elaborated. The difference of pressure between the gas as measured at the station meter and at the consumer's meter is an item which is on the right side, and is in favour of reducing the unaccounted-for gas, as the higher pressure of the station-meter compresses, and thereby reduces, somewhat the volume of the gas measured, which, of course, falls to be measured at the consumers' meters at a lower pressure and therefore at slightly increased volume.

There is a point which may be mentioned while talking of this leakage question, although it might be mentioned in connection with other questions. At a recent appointment, candidates were asked to give an analysis of their accounts with their application. I was not a candidate for this particular position; but it occurred to me that an analysis of accounts in the hands of town councillors, skilled men though they might be, might lead to very great misunderstanding of the relative position of gas undertakings. Even to a man dealing with gas manufacture every day, a clear view of the relative position of any two undertakings is always a matter of some difficulty. If an undertaking showed, for example, 3 per cent. of unaccounted-for gas and another showed 12 per cent. of unaccounted-for gas, but the capital indebtedness in the former case was about £200 per million cubic feet sold and in the latter £800 per million sold, might not the low leakage account be perhaps bought somewhat dearly? Yet circumstances might have prevented a large expenditure upon distribution in one case, while in the other money may have been readily available for putting in other mains, services, meters, &c. Is it altogether a wise step to introduce a matter of so much complexity, with its possibilities of misunderstanding, into a managerial appointment?

STEAM-RAISING IN GAS-WORKS.

Steam raising in a gas-works is generally looked upon as a purely subsidiary matter; but in the writer's case, with a works containing much heavy machinery, including hot coke conveyors and jigging screens, coke and breeze elevators, compressor for West's compressed air charging and drawing machines, three coal breakers and elevators, and the usual exhausters, pumps, &c., as well as a sulphate plant situated about 200 yards from the boilers, a large amount of steam relative to the size of the works is at all times required.

The amount of breeze needed to keep up the requisite steam supply approximated to 6700 tons per annum; and when I found it was necessary to have a better stand-by boiler than the old one, which served when one or other of the two 30 ft. by 8 ft. Lancashires required repair, I decided that, while I should put down a new boiler of exactly the dimensions of the two existing, I would also put down all the modern means of economizing in fuel consumption. The fuel you may say is very cheap, and expense necessary to effect economy in its use would require to be quite moderate. But supposing, in my case, breeze can be readily got rid of at 2s. 6d. per ton (at 5s. per ton lately), and it is possible, by using the best methods of feed-water heating, &c., to reduce your fuel

account by 20 per cent., then you will see that, on a consumption of 6700 tons per annum, 20 per cent. represents 1340 tons, which, at 2s. 6d. per ton, represents £167, or on one new boiler £83 per annum. Now this is quite a substantial sum, and an economy worth striving after. But there was another point which weighed with me; and that was the intolerable dust nuisance, due to the use of the blowers to get up sufficient steam. This dust—containing, by the way, 70 per cent. of combustible matter—choked up rhones, valley gutters, and down pipes. A most efficient boiler system, by reducing the amount of fuel, would also reduce the amount of dust. Again, to put cold feed water into the boilers was neither good for the boilers nor was it economical.

Having thus briefly indicated my reasons for putting down a new boiler with modern accessories, a brief description of the installation might be given. The boiler is a standard pattern Lancashire of the highest class, and has passed a test of 200 lbs. to the satisfaction of the Vulcan Boiler Insurance Company. Both end plates are turned outwards at the flue openings for the attachment of the flues. This was done as two existing boilers had both given way where the end plates had been flanged inwards to join to flues. The water for the new boiler is measured through a Glenfield and Kennedy meter, which is fitted with a bye-pass in the event of it sticking or requiring repair. The water leaving the meter passes into a small tank, from which it is pumped by means of a single cylinder double-acting pump with metallic packed piston, rod and slide-rod, made by Messrs. G. & J. Weir, of Glasgow. The water is carried along the boiler-house wall, and thence to a Holden and Brooke (type A) feed-water heater. This heater is placed on the top of a water storage-tank, where the exhaust steam from the compressor, exhauster, &c., at present discharges. This exhaust steam is led into the heater, whence lagged pipes convey the warm water down to the Green's economizer situated in the main flue of the boiler. The Green economizer consists of 96 tubes, 9 ft. long and 4½ in. diameter, with top and bottom headers forced together in sections by hydraulic presses, with metal-to-metal joints only. It is fitted with patent improved gearing, with positive reversing lever and steel shaft and Green's patent self-acting triple scrapers with overlapping joints. This economizer is, of course, provided with a safety valve.

After leaving the economizer, the water, now near or at boiling point, enters into the boiler through a Hamilton and MacMaster internal feed-water heater, where it is delivered so as to help the most rapid evaporation. The steam, when generated, passes through a Ferguson superheater, placed in the down-take flue. It is not a high degree of superheat that is aimed at here; the intention being to secure that the steam shall reach the distant pieces of the plant in the works in a fairly dry state. The steam, I should say, superheated by passing through the Ferguson superheater, will require, in the meantime at least, to mix with saturated steam; so that, as I have said, dry steam can only be looked for, and not superheated steam. There is one point I have not yet decided, and that is whether one or other of the constant level regulators on the market just now should not be used, or whether it would be better to depend on the man in attendance. If one of these feed-level regulators went out of order after a man had got accustomed to this work being done for him, a serious accident might result. The furnaces of the boiler have Neil's rocking bars; and should these not assist to give the desired evaporation from the boiler, forced draught has been fitted as a stand-by.

The total cost of this installation as described was £1050, including Poulton's curvilinear blocks and insulating bricks and the building of the setting. The interest required is 3½ per cent.; and as this amount goes solely to capital, and as there is a fixed annual sum paid in Greenock of £5000, which is not increased although plant expenditure may be increased, there is no extra depreciation to be paid on it. Consequently, £37 10s. meets interest on the cost of the boiler and accessories, and leaves a very satisfactory margin on the fuel economy. Even if only half the possible saving of £167 is obtained, or £83, this gives a good return on the investment. So far as I can foresee, the care and attention required on these extra pieces of plant will not be great.

WORK OF THE BRITISH COMMERCIAL GAS ASSOCIATION.

The British Commercial Gas Association is now fully launched, and over one thousand inquiries have already been received as a result of its advertising work. This is distinctly very encouraging; and I think a steady future of usefulness is assured for the Association. The response from Scotland, however, is not yet what it might be, as only 17 towns are subscribers. But I feel convinced that, once we in Scotland fully grasp the absolute necessity for combined action in this matter, there will be but few undertakings which will not subscribe. No concern is too small to have a share in the good work; and I trust that the legal difficulty which has been raised in some places may be overcome. The Association has no intention of attacking any rival. Its aim and object is to defend what gas has won, and to see to it that if gas is to be beaten it will be beaten absolutely on its merits, and not on demerits existing solely in its rivals' imaginations. The Association has as its first Secretary a man well known to most of you—Mr. William Mason—and in his firm and capable hands the interests of the Association are secure. It will, however, greatly strengthen and encourage Mr. Mason in his work if more of the Scottish corporations and companies send on their subscriptions.

THE "INFORMAL" AND NORTH BRITISH MEETINGS.

There is one other point I should like to mention, and that is that the "Informal Meeting" might quite well become the spring meeting of the North British Association. In these days of "sturm und drang," a united body would, I think, be much better than two existing side by side and covering some of each other's ground, with some waste of energy.

In the old days, a spring meeting absolutely independent in action may have had some advantages; to-day these advantages seem to be non-existent. At the same time, by the voting on the last occasion the subject was mentioned, there seemed a strong feeling for maintaining the *status quo*. However, I should strongly like to-day to have an expression of opinion on this matter from those present. The meeting itself would in no way be changed, but would go on as previously; and I can assure you that it would give me great pleasure, during my approaching year of office as President of the North British Association of Gas Managers, to welcome you to the spring meeting of the Association. I ask you not to think that any feeling of personal aggrandisement animates me in making this appeal to you. Any honour which has come my way in my profession has been absolutely unsought for by me; but I do appeal to you on the sole ground of what I rightly or wrongly believe to be the best interests and the solidarity of our great industry, which has done so much for civilization.

Discussion.

Mr. W. B. M'Lusky started the discussion. He said that they would all agree that they had enjoyed a very able and very practical address. But for the mention which had been made of the proposed absorption of the "Meeting" by the North British Association, it might have been regarded as ideal. In his mind, this was the only imperfection in an otherwise perfect address. This part of the address was utterly impracticable. It was sprung upon them before, they would remember; and he supported it then, simply to show them that he was taking an independent view. In his opinion, the vote went very strongly against them. He was one of the defeated at the time. The "Informal Meeting" had a place which the North British Association could not supply—a place which no other Association could supply. This meeting had interests which the North British Association had not. The latter Association, of which they were mostly all members, should be loyal and steadfast towards its own members. It had its own sphere; but that was not there. This was their meeting—a free meeting untrammelled by any kind of consideration but the work they were taking up on the day of conference. These were his views. They were considered views—views born of experience in handling these meetings, and views which he thought would be confirmed by all those who had benefited by these "Informal Meetings." He did not please to touch upon the strike, because he had had enough of it. [Laughter.] He did not propose to say much about vertical retorts. Mr. M'Leod had said nothing. He remembered a schoolmaster who spoke seven languages, and held his tongue in all of them. In regard to condensation, he (Mr. M'Lusky) made some observations in 1900 in his Presidential Address to the Waverley Association; and he could hardly help thinking that Mr. M'Leod paid him a compliment, because he said what he (Mr. M'Lusky) said then. The question of testing the station meter was one that had been present to him for some time, as he had been working under an abnormally low leakage account for many years. This low leakage was not brought about by any expenditure on capital account; it was brought about by keeping the valves and dry meters tight, and rooting out defective wet meters. Strange to say, his predecessors, Mr. Thomas Whimster and Mr. Andrew Wilson, laid their mains well and made good joints; it was left to him to reduce the leakage. It was chiefly due to the carrying out of the scheme which Mr. M'Leod had outlined—of seeing that nothing but gas was sent to the town, and reducing as far as possible the amount of aqueous vapour carried away. Another thing which had helped to reduce the leakage in Scotland was the fact that they had to a large extent stopped using shale and cannel coal, which contributed very largely to the leakage account of the country. In his experience at Perth, and consequent upon the alteration of condensation and purifying, the percentage of loss was reduced. Leakage was reduced from 7 per cent. to 2 per cent. There was another point. Throughout the time of reducing the leakage to 2 per cent., the sale of gas steadily increased, until the amount sold per ton of coal was the highest in Scotland, so far as he knew. If it were possible to sell so much gas per ton, it would surely bear out the argument for low leakage. They even found that a make per ton was bolstered up by a leakage. During the whole of his experience, he never paid any attention to make per ton—gas sold and paid for had been his standard. Mr. M'Leod had referred to a town council who asked candidates to send in analyses of accounts with their applications. In 1904, one of the more important corporations on the west coast of England adopted this scheme, and insisted upon candidates sending in completely filled-up analyses of accounts. This proposal did not do any harm. The same thing had been done in several cases during the past few years. He was not aware that in either of the two cases which he knew of personally anyone suffered. But an illustration would bring home to them his point. Supposing they took the case of an engineer or manager with a 12 per cent. leakage and a low capital account, Would it not be better that the two facts be presented side by side than that the candidate should run the risk of having his 12 per cent. leakage emphasized, and the fact that he had saved so largely in capital expenditure left out? If he had both facts brought out, he would surely be in a better position to have his application considered upon its merits. If the principle

was in favour of the candidate, the whole truth should be stated. They knew perfectly well there was no system at the present time which gave them so valuable an index to the works as these analyses of accounts. The British Commercial Gas Association had been referred to by the President. He might say that he had found great benefit from the Association, particularly since Mr. Mason went South. He would heartily impress upon them all the recommendation of the Chairman, that the gas undertakings of Scotland should support the scheme in a liberal spirit [Hear, hear]. He thought that Scotland had as much to gain as, and perhaps more than, any town in England; and it would be fitting to give the Association their hearty support.

Mr. W. B. Langlands (Glasgow) had listened with great pleasure to the addess. It was, he said, only the following-up and result of a career that had been a good one right through. Mr. M'Leod had started off by taking up the question of the use of the "Informal Meeting." With the North British Association, one must have his membership and other qualifications; but everybody could come to the "Informal Meeting." At the last meeting of the North British Association, he had asked that the qualifications might be broadened. Mr. M'Lusky said he had had enough of the coal strike. Had they had enough? [No!] Perhaps they had not. He hoped they had had enough, and that they had taken the lessons home and realized what it meant. Mr. Wilson, at the last meeting of the Scottish Junior Gas Association (Western District), dealt with the subject very fully—advocating storage. Was this the solution? Some people said they could advantageously use water gas in conjunction with coal to the extent of really saving when coal strikes were on foot. This was a point they wished brought out—the extent to which water gas could be employed. He would like to hear Mr. Yuill or Mr. Milne tell his experiences during the coal strike. The question raised as to the testing of station meters had a direct interest for him. It was a very proper thing that this should be looked to in all works. Many of the inflated figures given might have been inflated in the station meter. It was unfair to take analyses of account figures in the matter of testimonials. Could one always depend upon figures? They perhaps suffered by the method of comparison with their neighbours round about them. Somebody said that so-and-so sold gas cheaper than Glasgow. Did they? It was not what they sold their gas at, it was the convenience they gave the public, at a cost.

Mr. Henry O'Connor (Edinburgh), speaking on the subject of leakage, said that a good many years ago Mr. Lewis Thomson Wright carried out a number of comparisons with regard to the question of temperature at the station meter and at the consumer's meter. If his memory served him rightly, he found a difference of not more than 5 per cent. Of course, the temperature at which the gas was measured in the base was that which should be taken. The meter was inside the house; and therefore the gas was measured at the temperature of the meter, which, of course, was higher than the temperature of the main in the street. Referring to the station meter, Mr. M'Leod seemed to doubt that the registration had varying rates of speed. Provided that the station meter was of sufficient size, and the rate of speed not brought down to an abnormally slow one, the station meter should be regular throughout—that was, if it was fitted with a constant level overflow. Of course, to get it absolutely correct, water must be constantly flowing into the meter at a slow speed. Mr. M'Leod mentioned another point—that the compression of the gas when measured at the station meter in a small works when the pressure was low would not have much influence. Supposing the pressure at the station meter was 13·8 inches, $\frac{1}{2}$ lb. on the square inch, and $\frac{1}{30}$ of an atmosphere. If the gas was being measured at a pressure of 12½ inches at the station meter, there was a clear case of a compression of 3 per cent.

Mr. J. W. Napier (Alloa) defined the address as most scientific and practical. Mr. M'Leod had touched upon a subject which, in the affairs of technical men, had not received the attention which it ought to have received—namely, the correction of the volume of gas in all its stages. It was somewhat extraordinary that they, as practical men, should have been so careful in measuring their tons and their pounds, whether as coal, coke, or sulphate of ammonia. They all recognized the essential interest of having their practical results worked out upon an absolutely correct basis; and yet the extraordinary fact still remained that the physical body which was subject to the greatest amount of variation as regarded its volume was that which had received the least degree of attention. He expressed the hope that they, as technical men, would put into their practical work an element of scientific accuracy in the measurement of coal gas. Two years ago he carried out, during a period of twelve months, observations taking the temperature of the gas at the station meter, and the temperature of the gas at the main pipes and at the meter in his own house. Mr. O'Connor had stated that the proper place for the measurement of the temperature was at the consumer's meter. He (Mr. Napier) found that the difference between the temperature at the main in the street and at the consumer's meter did not amount to more than a degree at any time. It was certainly strikingly interesting that frequently the measurement of the gas during the winter months was made at a time when the temperature was as low as 34° Fahr. Reference had been made to the analysis of accounts on the part of those who desired the highest qualifications for their manager. In connection with works which would be able to show the best results, so far as these particular analyses went, the fact would be found due to the small leakage. If they made examination of the practical results of any particular undertaking, they found that they were considerably better than the undertaking which had enjoyed perhaps some considerable merit because of circumstances which were peculiar to the environment of the particular town. He thought it was well that this point should be brought out, because they would recognize that, if they were to be accurate in their comparisons, all circumstances ought to be taken into account. Mr. M'Leod, as a result of his observations, had stated that, in his opinion, the average temperature of 50° Fahr. might be taken as the basis of correction in arriving at the percentage which ought to be got in obtaining actual leakage. In his own experiment, he found an average of 46° Fahr. was the result. There was certainly not much difference. As regards the correction for pressure, this also was necessary at the station meter. But, of course, as regards the correction for pressure, so far as the gas sold was concerned, this was not readily got. He should like if Mr. M'Leod would give the meeting some information with regard to the high-pressure distribution system which his Council had determined to carry out. It would be interesting for them to know whether he was making a new departure, because it was a matter of live interest to almost everybody. Regarding the other matter which Mr. M'Leod had blurred across his communication—the linking together of this meeting with the North British Association—it was of so debatable a kind that he hardly liked to venture upon it. He was sure that the "Informal Meeting" had done valuable work in the past. It was linked-up with the names of men who had not only adorned the profession, but had occupied high positions. He had always contended that, where one had an individual projecting himself into the affairs of the industry—as was the case with their Association—one would have a wealth of elements and an asset that could not be obtained from another Association whose constitution had been built on routine lines.

Mr. William Key (Glasgow), referring to the conditions in Greenock in times past, held that they had then been up to date. Perhaps Mr. M'Leod might know the circumstances. Their Gas Engineer in those days was very successful—so successful in his working that he sold all the gas he made. He had no leakage account. There was no leakage at Greenock. Later on he got elevated to a higher post, and a successor came in. The successor found that, while the Corporation were proud of him, he could not attain to the same results. At any rate, he soon discovered that it was not a question of taking the temperature of the air or of the gas—it was a case of having kept down the water-line of the meter from 2 to 2½ inches. [Laughter.]

Mr. Samuel Milne (Aberdeen) stated that his feeling was that the North British Association might very well have a spring meeting. There was no need for a presidential address; they could discuss the difficulties that had occurred during the past winter. If it was to be informal in its character, possibly the reporters might retire altogether. He must congratulate the Chairman on his able address. The question of temperature in the gas was very interesting. But what did it all amount to? It was very necessary to bring down the temperature of the condensers prior to purification. Taking the gas in the holders, it would be interesting to know what temperature was obtained in the centre of the holder, both in summer and in winter. His own feeling was that, air being a non-conductor, gas also would be a non-conductor, and that they would have a rise in temperature in summer in the film near the plates, which were at a higher temperature, and in the winter time this same film would be chilled. He was interested to observe the method adopted by the author in raising the temperature of the gas passing the scrubber. Probably the same effect would be obtained by causing pressure upon the exhauster. He had observed that there was a rise in temperature due to the pressure in the gas at the outlet of the exhauster. Some considerable reference had been made to unaccounted-for gas. Personally, he made records of temperature at the station meters; but he did not use these figures. It was of really no importance to his mind to correct for temperature, except that one got a more uniform reading of the yield per ton of coal. In Aberdeen, they had been fortunate in reducing the unaccounted-for gas. He attributed this to the systematic inspection of dry meters. Some years ago, at an "Informal Meeting," the subject of dry meters was discussed. Some speakers said dry meters had now reached their high state of perfection. But those of them who took down their own meters and repaired them, might form a different opinion. He was not referring to one make of meters. On the question of candidates and analysis of accounts, he did not see that it was any advantage in submitting the latter to a board of directors or a gas committee. He could fancy the assistant from a works putting in an application and submitting figures of analyses of the accounts. What had he to do with the results there obtained? Mr. Langlands said it would be interesting to know how those of them with carburetted water-gas plants had fared during the crisis. Speaking for himself, at Aberdeen they had had not less than 25 per cent. of carburetted water gas supplied during the strike. There had been no trouble or complaint with regard to the gas so long as they maintained 25 per cent.—only if they exceeded 25 per cent. If they went on past this figure, there would be trouble with the incandescent burners, cookers, fires, and engines as well. He found 25 per cent. was a very safe limit; and this was what they had been doing throughout the past six weeks.

Mr. A. Yuill (Dundee) congratulated Mr. M'Leod on the nature of his communication, because he had touched upon a great many

themes with which they came into contact in their every-day work. They all felt that they must give a considerable degree of attention to the temperature of their gases. Some had remarked: "What does it matter in paying attention to the temperature of the gases when you are subject to the extreme cold at the consumers' meters?" But there was another phase in connection with this question in dealing with temperature, more especially up to the point of purification. It meant either considerable economy or loss. The temperature after purification only affected the volume, and to the consumers probably loss in calorific value. It was a question worth studying. He would like in one word to give a little experience—his experience, with reference to carburetted water gas. He thought Dundee and Aberdeen were the only two works in Scotland which had had benefit; and he used this word advisedly. He thought everyone would find a pleasureable delight if he had an apparatus that effected 25 per cent. in consumption —in their case, 75 tons of coal in twenty-four hours by the use of carburetted water gas. This was the means of allowing him to lose not a single hour's sleep during the miners' strike. Like Mr. Milne, he found they were quite safe going to 25 per cent.; and he would not advise anyone to go beyond this. In dealing with gas from common coal, the illuminating power was not now so high as it was at the inception of the "Informal Meeting." But even in the present condition of things, with the mixing of 25 per cent. one was safe. The difficulty was in adding more than 25 per cent. More difficulty would be found with (say) cooking-stoves, boiling-rings, and gas-fires than with incandescent gas-burners. He could speak from experience of the great benefit of having carburetted water gas at their command. Like the Convener, he thought the Chairman was ill-advised in even mentioning one other subject in his paper. They all knew the source from which it sprang on the last occasion. He did not want to mince matters when he said that this was inspired on the last occasion. Possibly the Chairman, if he were candid, would enlighten them on this point—if it sprang from his own imaginings, or if he had been inspired at the meeting of the North British Association to raise the point. He was speaking upon information that he knew, and information that he heard on the last occasion. It ill-became the North British Association to act in this way, considering the value derived from the "Informal Meeting" in the past. Their meeting differed somewhat from the North British Association. They had gentlemen there who, though they were not gas managers, were in every way qualified to assist and take part in the debates, and who were not members of the North British Association. On every side they heard the remark "I like the 'Informal Meeting' better than the North British." The free-and-easy meeting they had would, he hoped, continue.

Mr. DAVID VASS (Perth) thought a mistake had been made by the last speaker. In his opinion, there was no personal element in the discussion as to whether the "Informal Meeting" should be part of the North British meeting or not. He might be wrong; but he thought he was one of the first raisers of the question five years ago. He was still of opinion that it would be for the benefit of both Associations. He failed to see where any difficulty came in; and he would have no hesitation in bringing it up as a formal motion at the North British Association meeting. But the matter would be better discussed by appointing a Committee to bring up a report and say whether such amalgamation could be carried through. He was very much "sat upon" on the former occasion when he brought it up. It had only been brought up by members in the interest of the meeting, and was not a new affair at all. In Airdrie, about two years ago they introduced a high-pressure main to "boost-up" pressure in a low-lying district. It was then their intention to put in a check valve. After getting the high-pressure gas into action, they found it was not in the least necessary to put in this check-valve. They found that they required the high-pressure main for high-pressure lighting. As it was, it was working perfectly. The pressure was increased from 7-10ths up to about 2½ inches, and had done away with very serious complaints in the district.

Mr. ALEX. WADDELL (Dunfermline) stated that high-pressure was introduced in Dunfermline some years ago; and they were able to maintain the same pressure from the time they put it in. He did not remember any single occasion on which they had any trouble.

Mr. WILLIAM BLAIR (Helensburgh) found that his experience led him to believe that in a severe winter their unaccounted-for gas went up; but with a temperate winter it went down. A short time ago, he saw a comparison made in some of the London Gas-Works, whose unaccounted-for gas ran up to about 3 to 5 per cent. But their unaccounted-for gas per mile of main amounted to 300,000 to 600,000 cubic feet. They certainly had a low unaccounted-for gas for their sales, but a big loss per mile of main. Take his own case. He was selling 1,200,000 cubic feet of gas; and his unaccounted-for gas bill was 7·25 per cent.—a loss of 118,000 cubic feet per mile of main. Personally, he had never bothered himself very much about his make per ton of coals; but his sale per ton of coal was the thing that worried him. So far as the asking for the analysis of the year's working from any applicant for a situation was concerned, if he could produce two returns, the year previous to his entering the situation and the year up to date, and show the difference that had been made, he did not see that it would do anyone any harm. They could only get to the bottom of things by telling the truth. As to getting the "Informal Meeting" brought under the wing of the North British Association, he made the suggestion a few years ago and was very nearly pulverized for doing so. [Laughter.] He did not see why they should not hold it under the North British Association. There were so many meetings held that it came rather stiff on some of them attending them all. He did not care, however, whether the "Informal Meeting" was under the North British Association wing so long as they had the privilege of meeting and discussing matters of prominent interest that had occurred in their different districts during the past year.

Mr. JAMES M'GHEE (Glasgow) said he was not directly in the manufacture of gas; but with reference to the unaccounted-for gas, he had not heard anyone stating anything about any definite period of bringing in their meters for verification. He saw one or two manufacturers advertising certain meters sitting in the same situation for fifty years, and registering quite accurately when brought in. Their experience in Glasgow was that they had brought in meters thirty years out registering accurately. They had had new ones brought in 10 per cent. out. A standard was being adopted in Glasgow. They started about four years ago by giving instructions to inspectors to attend to meters out for fifteen years. These meters had all been brought in for repair. After this they tackled those out for twelve years. The twelve years meters were nearly all in; and their intention was now to take in the ten years. They proposed making ten years the limit of allowing a meter to remain out. There was a method of testing meters in circuit; but he did not think it was handy, more especially in Glasgow, with close on 300,000 meters. As to the renewal of branches, on one occasion when the inspectors went to excavate there was no branch left—there was simply a shell taken out.

Mr. LAURENCE HISLOP (Uddingston) thought Mr. M'Lusky struck rather an awkward key when he spoke of the amalgamation of the two meetings. Now that Mr. M'Lusky had gone to that wonderful "land of gold," England, they thought his views would have been broadened. They were brought back to the time when the North British Association held out from amalgamation with even the Institution of Engineers. Some of the discussions at the present meeting were of more value than many of the contributions to the North British meetings. Regarding temperatures, he thought it was given on good authority that the variation between summer and winter in the temperature of the mains—taking them as being some 2 feet below the level—was not 4° Fahr. Mr. M'Leod spoke of the main crossing a bridge. Well, if the temperature of the gas was going to be very much altered in this 25 feet, what about the miles of mains it had to pass through after that? It should be brought up to its original temperature.

Mr. M'LUSKY, replying to Mr. Hislop, said the North British Association could not get a Spring Meeting unless they were altogether annihilated. That he believed was at the bottom of the whole proposal. The question struck him in this way: Was the Informal Meeting to be destroyed for the purpose of letting the North British Gas Association have a Spring Meeting? He thought it would be generally agreed that this meeting was a feeder of the North British Association. They had the feeling that in this meeting the younger men spoke first. They spoke there before speaking at the North British Association. It seemed to him that if the meetings wanted amalgamating, they could do this now. If they did not want it, they could say so.

The CHAIRMAN explained that he thought it only right with such divergence of opinion to take a vote. There could be no change in the meeting whether it was under the North British Association or not. The meeting would be just as harmonious. It would only be right to test the feeling if the meeting should become the North British Spring Meeting or retain its *status quo*.

Mr. M'LUSKY moved that they proceed to take the vote, and Mr. HISLOP seconded.

Mr. YUILL protested that the procedure was wrong.

The CHAIRMAN: We have no procedure; we are here as an "Informal Meeting."

Mr. YUILL said that someone came in and asked to be absorbed. From their point of view, they must retain the *status quo*; and it was for those who wished to woo them to come to them. If it had been moved and seconded that this meeting come under the auspices of the North British Association, then he was prepared to move that it remain as it had been for the past thirty years. Let them bear in mind the reasons why the meeting started. They were dealing with historical matters. It was well known that the meeting took the place of the then West of Scotland Gas Managers' Association, which was absorbed by the North British Association of Gas Managers. It appeared to be a strange irony of fate that after the lapse of thirty years and the amount of good work that the meeting had done, the North British Association should come and wish to annihilate them.

The CHAIRMAN: This proposal is made "off my own bat." You have no right to think I am inspired by anyone to put this matter before you.

Mr. YUILL continued that he was speaking from the historical point of view, and thought he was quite right in saying that two years ago this movement first emanated from the North British Association, and last year a conversation took place in the North British Association again. At the first meeting since then, the President included the question in his address. How far was he (Mr. Yuill) wrong in saying that it had emanated from the North British Association?

The CHAIRMAN: You are wholly wrong; entirely wrong.

Mr. YUILL: Is it not the fact that two years ago the Committee of the North British Association came into our meeting, when

business was almost over, and were permitted by the then President to move that this Association should be absorbed?

Mr. J. CARMICHAEL (Barrhead): You are quite right.

The CHAIRMAN: Undoubtedly these points are correct. But you began by stating a point that was absolutely incorrect. The point was that I, at the instigation of the North British Association, brought this forward. I did not.

Mr. YUILL: I asked you if you were inspired.

The CHAIRMAN: Well, that was entirely out of order.

Mr. YUILL: As Chairman of this Informal Meeting and Vice-President of the North British Association you have included that in your address. You admit the points I have raised.

The CHAIRMAN: I cannot have this at all. We must proceed to business.

Mr. CARMICHAEL thought the whole matter was being rushed, and proposed that they defer taking a decision on the matter until next year, to give them time to consider it.

Mr. DAVID VASS seconded, with the proviso that a Committee be appointed to consider the matter and report to the next annual meeting on what lines amalgamation could be carried out.

Mr. CARMICHAEL said he could not accept the proviso.

Mr. M'LUSKY held that they were mixing the main question. The only motion before the meeting was whether a vote be taken upon the question or whether it should not.

A show of hands was taken; 14 being in favour of voting on the question and 19 of not voting. The *status quo* was therefore retained.

The CHAIRMAN at this point handed over the chain of office to Mr. Samuel Milne, who takes the post of President for the next year. He then replied to the discussion at some length. On the adequacy of coal storage, he held that, as they had been warned by the miners' leaders that the next strike would not be one where they were forearmed, coal storage should be provided by all of them. He was glad to hear Mr. O'Connor's remarks about station meters. He had been informed that it had been known for station meter manufacturers to ask a manager at what precise degree of accuracy he wished his station meters made. Mr. Napier corroborated his temperature results. A matter of four degrees was not much. Mr. Napier asked about the high-pressure main. It was in a very embryo stage; and in these circumstances he had not much to say beyond this, that it was proposed to connect right from the works to the extreme end of the district. The main would be tested up to 50 lbs. pressure. It was his expectation, having had several inquiries for the use of high-pressure gas, more especially from two aluminium foundries in Greenock, that they would have a good future. Mr. Key had talked about the old days in Greenock when Mr. Ritchie sold all the gas made. He had known a man who stated he sold more gas than was made. Mr. M'Ghee's remark about meters being wrong after a short time was corroborated by his own experience. He had had meters wrong before they ever went out at all. He was sorry no one had slated him on one point—as to whether it was possible or not to deliver the gas at practically a uniform temperature leaving the works. If it could be done, it solved the difficulty of having to correct their gas by means of pencil and paper. If they were going to send out gas at a temperature of 50°, they could not retain the same amount of naphthalene as at 60°. If they could retain the gas at a fixed temperature of (say) 63°, once it got into the main and was properly covered by the soil, there could be very little change; and they were going to retain their naphthalene in suspension. Consequently, they were going to decrease their naphthalene troubles to some extent. He concluded by thanking Mr. M'Lusky for the work he had done and for the able way in which he had conducted these meetings.

Mr. M'LUSKY said that such thanks were good wages indeed. It occurred to him that as Mr. Napier, of Crieff, was closely identified with the West of Scotland body, from which the "Informal Meeting" sprang, it would be a nice compliment to Mr. Napier, of Alloa, if they gave him the position of Convener.

Mr. NAPIER returned thanks for the honour, and said it would be his endeavour to preserve the traditions of the Association.

Mr. YUILL heartily thanked Mr. M'Leod, who smilingly said that the battle being over the hatchets would be buried.

DINNER AND A PRESENTATION.

At the conclusion of the business, the company dined in the hotel—Mr. M'LEOD presiding. The function was marked by a handsome presentation to Mr. M'Lusky on the occasion of his retirement from the convenership.

Mr. YUILL, in making the presentation, said he was sure most of them would be pleased at the success of the little venture. He had had a hundred subscribers, and a total amount of £73 17s. 3d. When Mr. M'Lusky's biography came to be written, no doubt it would be educative to their young men from the part he played, and it would form a second edition to Samuel Smiles's "Self Help," when they took into account his position—the position he rose from and the position he had attained. Some might say that Mr. M'Lusky appeared to have the fortune of becoming early associated with gas-works. He (Mr. Yuill) did not wish to follow Mr. M'Lusky in his various perambulations through the whole of his early days; but it was a matter of history now that his first position was in that quaint little town within the noise of the breakers that broke on the sands of Solway. He did good work there—work that remained as a record to the present day, and as an example to those who had followed. He performed the same mission in Kelso and in Selkirk; and then they found him beginning to change his love to the "Fair Maid of Perth." They all knew the success he met with in Perth. He thought he was over ten years in Perth; and they did not require anything else than to look at the complimentary dinner which had been given to him on leaving. Let them hope that, in the selection he had now made to go South, he would be able to hold up the Scottish flag and allow no one to sully it. He asked Mr. M'Lusky to accept the gifts—a clock and ornaments, a silver tea and coffee service (a replica of one made in the time of George I.), with a handsome necklace and pendant and a room cabinet for Mrs. M'Lusky.

Mr. M'LUSKY in a few words thanked the Company, referring to his close connection with Mr. Yuill.

Presentations to a Water Company's Officials.

The Directors of the Wrexham and East Denbighshire Water Company recently held a meeting for the purpose of recognizing in a tangible way the completion of forty years' service by their two principal officials, Mr. Frederick Storr, the Engineer and Secretary, and Mr. Robert Roberts, the Accountant. The Chairman of the Company (Mr. J. Allington Hughes) presided. After explaining the object of the meeting, and referring to Mr. Storr's work, more especially in connection with the construction of the Ty Mawr reservoir, he expressed his pleasure in presenting to him a silver tea and coffee service, together with a salver suitably inscribed, and said he sincerely trusted Mr. Storr would be long spared to the Company, and that the pieces of plate might remain in his family for generations to come. He afterwards handed to Mr. Roberts a silver salver, saying he hoped it would be of much service to him and to Mrs. Roberts, and that they would be spared for some years to make use of it. Several speeches were made in appreciation of the long and faithful services of the two officials named, each of whom made appropriate acknowledgment. Mr. Storr gave some figures showing the growth of the undertaking. He said that the revenue had risen from £1400 to between £12,000 and £13,000, while the capital had increased from £19,600 to £207,000; and instead of serving three parishes, the Company now served fifty, three counties, and five unions—the total population approaching 36,000. He added that he looked forward to completing his life-work in the Company's service. Mr. Roberts, in the course of his remarks, referred to the harmonious way Mr. Storr and he had worked together, and expressed the hope that they might both serve the Company for some years to come.

The Askania Automatic Gas-Lighter.

Reference was made in the report of the German Continental Gas Company for the past year [see "JOURNAL" for the 26th ult., p. 911] to the extended use of the improved Askania distance lighter, which is made in the Company's workshops at Dessau. The lighter in its simplest form is applicable to single gas-burners, either upright or inverted, and comprises a valve, attached to the burner, by which the gas supply is directed to either the bye-pass or the burner flame, according to the position of the valve. The valve is operated by means of a lever tap or switch, which is placed at a point convenient for lighting or extinguishing the burner. The gas supply is carried past this point, and the tap in one position allows enough gas to pass at a sufficiently reduced pressure to keep the igniting jet-flame only alight. In the other position of the tap, gas passes freely, and the increase of pressure when the tap is first turned to this position operates the ball valve attached to the burner, so that the way to the burner head is opened. The gas issuing from the mouth of the burner is ignited by the small jet, which is momentarily enlarged owing to the increased pressure, and is then extinguished by the operation of the valve. The apparatus appears to have the merit of simplicity and freedom from parts which are readily liable to get out of order; but it requires careful adjustment on its installation, and has the disadvantage over many other forms of automatic lighters that the gas supply has to be carried past, or to and from, the point where the tap or switch is placed. The apparatus is also supplied to operate from one tap a number of burners placed in series, and also lanterns containing two or more burners, such as are used for show windows, factories, workshops, railway stations, &c. An automatic igniter, depending on the action of a friction wheel on a piece of alloy of cerium and iron, is also made in the Dessau workshops of the German Continental Gas Company.

The last book of rules and list of members of the Society of British Gas Industries, of which a copy has been forwarded to us by the Secretary (Mr. Arthur L. Griffith), furnishes evidence that there was a place for such an organization, and that the manufacturing firms have recognized its value to them particularly, and to the gas industry generally. The list of members comprises 93 firms; and the Chairmen of the various sections of the Council (the Chairman of which is Mr. Thomas S. Clapham) are all well-known men in their special departments. In Mr. Corbet Woodall, the Society have for President one who, as Governor of the Gas-light and Coke Company, occupies the highest position in the industry; and he could not have had a more distinguished list of predecessors than that contained on the second page of the book,

SOME REMARKS UPON GAS SUPPLY.

By Samuel B. Chandler, of the South Metropolitan Gas Company.

[A Paper read before the London and Southern District Junior Gas Association, April 26.]

The rapid progress made in means for lighting, heating, and power, in all industries—especially those dealing with heat-energy—have, as a consequence, brought about very strenuous competition and the development of special departments designed to cope with it; and the relations existing between the manufacturing and sales staffs have, for this reason, become more closely allied and bound together, in the recognition that the success of the one depends to a large extent upon the continual efforts of the other more or less for its prosperity. Marked improvements have shown themselves during the past few years in all classes of industrial appliances connected with, and in the production of, heat, light, and power (notably, in our own industry, forms of apparatus for use with gas under high pressures—to cite but one example); and the aid of science has been called into requisition to deal with the manifold problems affecting it by manufacturers who desire to keep abreast of the times.

The remarks of our President some short while ago, that science and much experimental work are involved in the production of means whereby the gas industry may maintain its position in the commercial sphere, are, I think, quite justified; and we may take it for granted gas (manufacture and distribution alike) has long since passed the "wait-and-see" era, and that scientific research and mathematical practice are to-day as much needed and employed in the control of a gas undertaking to its ultimate welfare, as in any other industry which has all along had to depend upon them. I refer more particularly to the electrical industry, which, it must be admitted, is one of science and experiment. Experimental work continues to go on; and fresh methods are being devised to obtain a greater duty from coal for use, through the medium of gaseous fuel, in power, lighting, and heating, besides which strenuous efforts, by advertisement, show-room, practical demonstration, and personal representation, are being made to educate the public to the economical advantages to be gained by the use of gas for numberless private and industrial purposes.

The would-be consumer, having such a variety of appliances at his service, is far less likely to accept the first form offered, either of energy or apparatus; and, in consequence, he often hesitates between rival forms, knowing full well he can pick and choose, and that no effort will be spared to obtain him as a customer.

Such changed conditions as I have mentioned call for (and, indeed, have produced) a special type of man. By this, I mean one well up in technical and theoretical knowledge (and with the capacity to utilize it), as well as commercial acumen and up-to-date information of appliances and improvements effected, not only in his own industry, but in that of his competitors. Added to these necessary qualifications which go to make the capable representative, personality plays a very influential part in the administration of our business; and a pleasing manner, coupled with courtesy and lucid explanation and the desire to serve, will inspire confidence, and oft-times effect the desired purpose, where otherwise failure to achieve it might have resulted.

The gas industry enjoys the support of all classes—the poor and wealthy alike—and occupies, to my mind, a unique position in the commercial world. With coal gas as a medium for use in the production of light and warmth, it is difficult to imagine any household in which it is not utilized for at least some purpose (apart even from the lighting question), either for heating by means of fires, convectors (commonly called radiators), flueless stoves (not, of course, for living-rooms), and hot-water pipes, or in the production of heated water for all domestic and general purposes through the medium of a gas-heated boiler, "circulator," or instantaneous water-heater (geyser)—the thermal efficiency obtained in some forms of modern appliances being in the region of 85 per cent. of the fuel used. The production of hot water by gaseous fuel has the very close attention of gas official and manufacturer alike; and new methods are constantly being devised whereby forms of this class of apparatus are reaching a most efficient point, and will possibly prove in the near future a very serious rival to the coal-range as used constantly. The public are already appreciating the system, especially when used in conjunction with the existing circulatory schemes, and more so as some gas companies now adopt the rental and hire-purchase methods of installation. This additional outlet for our commodity represents a very welcome load to the station engineer, and may be regarded in the light of an increasing one; and, generally speaking, I think we can look forward with great confidence to the time when each residence will be fitted with an appliance of the description referred to, or suitable provision made for it when building.

It will, I am sure, be agreed that the co-operation and interest of the architectural profession and builders should be sought and obtained, and their valuable assistance given in questions relating to the disposition and the fixing of supply-pipes—especially for heating purposes—while buildings are in course of construction. These precautions represent a saving to the future occupier, as less disturbance takes place upon the installing of fittings, fires, and appliances, when supplies are in—besides, of course, the extra expense of running them. Another point to be remembered is that such conditions present a very forcible lever when the persuasive powers of the gas official are brought into play with a view to installing his commodity, as, in my experience, prime cost is a great factor from the consumer's point of view. In some cases, of course, the initial expense, or part of it, falls upon the undertaking; but in the long run a fair return is obtained.

Questions involving the lighting of buildings must be studied and dealt with according to particular circumstances; and in this connection the personal requirement has to be taken into consideration and catered for. It is a little surprising to learn the views of many consumers regarding the illumination of their premises, not only as regards the quantity of light required, but also the placing of the sources. But no two cases are similar; and it is for us to advise and carry out the wishes of our customers. Speaking generally, I am afraid standardization is out of the question where one has to contend with the "man-in-the-street;" and the result of lighting-up premises by a standard of illumination obtained from a photometric basis would not always produce the result desired or approved of by the consumer. There are, of course, some very useful general rules which may be considered, and in some cases followed out; but with a lighting medium which allows of some latitude on the side of being slightly overdone by reason of its economical cost, I do not think there is much need for us to worry over absolute precision in questions of general lighting. Regarding the outside lighting of shop premises, when one comes to consider that (to give an instance) one large up-to-date business firm (whose name could be furnished) employ nine separate systems of lighting in illuminating their windows, I think we may take it that no standard of illumination can be followed or generally employed, in this direction at least, for a long while yet to come.

Gas has been extremely successful since the advent of high-pressure lamps in the lighting of our streets and more important thoroughfares, and is more than holding its own in competition with electricity. Street lighting contracts—or some of them—are now based upon a certain standard of illumination; and suppliers agree to produce this during the term of the contract. This is as it should be; and I do not refer to this application of lighting in my foregoing remarks.

To my mind, a very grave defect in the application of high-power lamps (especially the flame arc lamp, the effect of which at close range is to produce colour blindness) is the very inartistic and distressful glare associated with large units suspended from the facias of business premises without adequate shades or reflectors, and within 7 ft. 6 in. or 8 feet of the street-way. But I must agree that the consumer is more often than not to blame for this, despite any advice of the lighting expert; and I believe the tendency to-day is for still more light. The question arises, Where will it end? for every year sees a general increase in brilliancy and the utilization of higher power units.

Apart from the question of cost, "light for light," gas has until very recently had to fight against—among other things—prejudice and a natural bias as expressed by makers of rival forms of illuminant. Much has been written and said about the unhygienic part the combustion of gas plays in our everyday life; and various products have been pointed out as deleterious to health, plant-life, leather, pictures, &c. In short, this form of lighting and heating has been condemned wholesale by the uninitiated, who have not studied the question closely, and others interested in different forms of energy. But after the severe trials to which both gas and electricity were, under strictly scientific conditions, subjected by Dr. Rideal in his investigations in 1908, results were shown which disproved the unhealthiness of gas, and once and for all demonstrated that the choice between the two systems does not rest upon hygienic considerations at all.

I may perhaps be pardoned if I refer to one or two conclusions drawn as a result of these experiments. As is well known, the burning of any gas consumes oxygen, and is accompanied by the emission of certain products (in the case of coal gas, carbonic acid, water vapour, and certain sulphur substances), giving at least twice as much heat as results from an equal illumination by electricity; and if burned in an air-tight compartment, it would, of course, quickly exhaust the oxygen—the products necessarily accumulating. This condition, however, does not exist in any actual living-room, since an active and constant interchange of the air takes place—heat being very freely conducted through the walls, ceiling, interstices of doors, windows, &c. Though, in the experiments referred to, precautions of a special nature were taken to prevent ingress of further air, the composition of the air with the gas illumination showed no marked difference from that with electricity; and the condition of the room was practically the same as regards heat with both forms of lighting.

The proportion of carbonic acid in the air was practically the same for both illuminants—showing that the ventilating effect of the gas was quite competent to carry off the whole of its products, or an equivalent amount of the products of human exhalation; and it was found that the search for physiological effects of lighting by gas was, in the main, a fruitless one. It was also proved that the bacterial contents of the air in the rooms were less with gas than with electricity owing to: (1) The cremation of organisms by the gas-flames; (2) sterilizing effect of sulphur oxides from the gas; (3) increased condensation on the surfaces removing such organisms and sulphur products. As a consequence, condensed moisture under electric light contained numbers of living organisms, while that under gas remained sterile. The gas-burners used were of the inverted bijou type, 25 nominal candle power,

each consuming on an average 1·28 cubic feet of gas per hour, and fitted with bye-passes. The electric glow lamps—carbon filaments—were also of 25 nominal candle power, and had an average current consumption of about 94 watts each.

As an illustration met with in every-day experience, in a room (say) 15 feet by 13 feet by 10 ft. 6 in., not more than 4 cubic feet of gas would be required to give efficient illumination, as used in a modern inverted burner.

The carbonic acid produced by combustion . .	= 2·4 cubic feet.
The water vapour produced	= 5·2 ,, ,,
Making a total of . . .	7·6 cubic feet.

in a volume of (roughly) 2000 cubic feet (or 0·38 per cent. of the total cubical contents).

The sulphur oxides produced (approximately 1·6 grains), being soluble, are carried away with the water vapour. It will be seen, therefore, from this example, how infinitesimally the oxygen is lessened and interfered with, and how little the occupant is troubled by the effects of combustion—especially when one takes the ventilating effect into account. These observations apply also, in the main, to modern gas-fires when fitted with efficient ventilating media; and with the attention now given by gas undertakings to this class of heating, and the careful study made to avoid down-draughts and other objections experienced in the many kinds of chimneys met with (Mr. Browning's admirable paper proving very helpful in this direction), the field is still very wide for this type of apparatus.

Gas, as with any other form of heat-energy, can, of course, be used indiscriminately, and in such fashion as will not prove beneficial to the consumer. This is where the technical official of the gas company steps in, and, given the chance, remedies the defect, suggesting possible economies and better efficiency, resulting in that desideratum the "satisfied consumer"—the ambition of every gas man. The medical profession—hampered, however, by the rules of the Medical Society as regards allowing their names to be used for purposes of advertisement—is, I think, at one with the gas industry upon the question of the hygiene of gas, when it is applied in a proper manner, for heating, although there will, I am afraid, always remain a few who do not agree with the use of anything in this connection but solid fuel, pinning their faith to that finest of all smoke producers, possibly because they have never interested themselves in the question and hold prejudiced views, for which reason gas spells anathema to them. It is this section we must convince otherwise, and win for our industry.

The chaos created in the industrial world by the recent coal strike has brought home very forcibly to householders the benefits to be derived from the use of an economical form of heating and cooking (though I do not think much doubt exists in the average person's mind as to the latter); for with solid fuel fluctuating and steadily increasing in cost, the public can afford to remain at ease if they have wisely adopted the gaseous form, and had a system of water heating installed, besides perhaps fires and the necessary (I had almost said, indispensable) cooking-stove. The admirable foresight of a number of gas undertakings in storing up large quantities of coal for such a contingency, and the consequent steady price of gas and coke, has, I think, been much appreciated by the public; and the companies concerned have, generally speaking, benefited. To my mind, much good has been effected; and I think it augurs well for future extension, if only by reason of the fact that many have perforce had to fall back upon gaseous in place of solid fuel—so having had brought home to them in a practical manner the economies to be effected by this form of energy.

Speaking of labour troubles brings me to a subject which has been ventilated a great deal during the past few weeks, and which it is generally agreed goes a long way towards the certainty of peaceful and amicable working, having (so far as I myself am aware) in our own industry been the means of preventing serious labour friction and stoppages such as we now regard as somewhat commonplace and of frequent occurrence, and a much-to-be deplored evil associated with coal, railway, and many other trades. I refer, of course, to the eminently satisfactory scheme known as co-partnership. The movement is a spreading one; and at the present time there are, I think, some 31 gas undertakings in this country which have adopted it, representing a total capital of over £47,000,000. I believe it is only by a general taking up of this scheme that a panacea will be found for industrial strife. We have, of course, to thank the late Sir George Livesey for the benefits now enjoyed, not only by the employees of the large London companies, but by many smaller undertakings which have embraced the scheme; and it goes without question, to my mind, that it is by his foresight and action that we occupy so substantial a position as we do in the industrial world to-day.

Discussion.

The PRESIDENT (Mr. J. G. Clark), in inviting discussion, remarked that the paper was a thoughtful one, and opened up quite a number of matters.

Mr. S. A. CARPENTER (Mill Hill) said Mr. Chandler belonged to a family who were very well known in the gas industry; and he hoped that the present one would not be the last paper the Association would have from him. The author mentioned the point of giving higher power units. This was a matter which had struck him (Mr. Carpenter) several times; for the demand did seem to be for more and more light. They must come to a stop sooner or later, as they could not go on increasing the units for ever. But this was a matter which he thought would effect its own cure, because in time shopkeepers would begin to feel the expense, and this would have a tendency to keep it from continuing to grow. An important point in connection with street lighting was that the very high units rather led to patchiness. A main street would be so brilliantly lighted that when one went from it into a side thoroughfare this (though in reality well lighted) would seem in comparison with the main street quite dull. It was known that accidents had arisen from this cause. It was true the subject of the paper was one which might be treated from several points of view. For instance, some of those present no doubt had seen letters from irate consumers which might well be labelled "Some Remarks upon Gas Supply." As gas suppliers, of course, they did not pose as philanthropists; but he thought they might claim the title of social reformers. Before the streets were properly lighted, robberies after dark were of common occurrence. At that time their streets were supposed to be lighted; and every citizen was compelled to hang up a lantern outside his premises. He was not, however, obliged to put a light in it; and, under these circumstances, the thoroughfares were unsafe after dark—a state of things which was altered by the introduction of more efficient street lighting. It did not seem to him that it would be desirable to standardize shop lighting, because the proprietors would not like all to be the same in this respect. If a particular lamp was recommended to one man on the score that several other shopkeepers were using it, this might be regarded by him as a reason for not adopting it.

Mr. D. J. WINSLOW (Lea Bridge) remarked that it seemed doubtful whether at the present time they had enough fitters of sufficient education for their work. There were all kinds of gas-fitters; but he thought there was room for a better class of man in this line. They had, of course, already in many cases exceptionally good fitters. The average youngster, when he left school, evinced a desire to enter the office, whereas he would frequently find he had a better chance if he devoted himself to fitting work. In these days of classes in gas supply, such young men had held out to them an exceptional opportunity of pushing their way forward. He was glad to hear the author recapitulate Dr. Rideal's experiments. Attention could not be drawn to them too much. Keeping these facts well to the front must assist the progress of the gas industry. A good point made by the author was in connection with the piping of new premises. Of course, gas companies would like to see every house that was built piped for all purposes; but it was the question of cost that somewhat stood in the way. It was hardly fair to expect gas undertakings to bear the whole of the cost; but it was difficult to get the builders sufficiently interested to put pipes in themselves. They should get hold of architects and show them the advantages of having buildings properly piped when in course of construction. On the subject of gas for heating purposes there was a matter that had occurred to him. Suction gas producer plants were being very severely hit now by the local electric light companies supplying motors on hire and hire-purchase, and charging a nominal rate for current. There was thus not the same demand as formerly for suction gas plants for this purpose; and apparatus of that kind was being turned to other uses. The biggest competitor of the gas industry in the future for the supply of heat would, it seemed to him, be suction gas pure and simple. It was quite easy, he believed, to provide a fan or something of the kind to draw the gas from the producer and send it through the pipes. Special burners were being made at the present time by which the gas could be used in furnaces for japanning, annealing, &c. In this way they would be hit, unless they could reduce the price of their gas considerably to meet the competition.

Mr. W. E. BROWN (Gaslight and Coke Company), referring to the question of piping new buildings, remarked that, if the gas companies did not do something, it would mean that buildings would be put up without a single gas-pipe in them—especially where there was electric light. Unless the gas companies were prepared to do the work if necessary at practically a nominal price, there would be no pipes in the buildings. If property was of such a nature that the occupiers might be expected to use gas-fires, proper provision should be made for these.

The PRESIDENT said that Mr. Chandler had referred to experimental research. The gas industry might feel proud of the fact that the older gas engineers had included some very able experimenters. The names of Mr. William Sugg and Mr. George Bray occurred to him, among others, as those of men who would rank as experimenters in the true sense of the word, and who represented the older school of the gas industry. They had also, of course, some able experimenters still with them. It was no doubt true that the consumer benefited by competition. He knew that he had the choice between quite a variety of things; and he was thus able to play one off against the other, and secure the best. A thing they ought to bear in mind was the possibility of special matters cropping up at any time. A consumer might say that he wanted something done which would involve a process quite different from anything the company had carried out before; and this was specially the case with users of gas for industrial purposes. Jobs came along which had never been tackled by means of gas; and it sometimes required a little ingenuity on the part of the inspector to meet the demands. There would, he thought, certainly be difficulty in securing a uniform system of lighting. He agreed with Mr. Carpenter that a tradesman liked to preserve an individuality for his shop; and the fact that a man next door had

a particular lamp was probably a reason why he himself would not have it. They would find also that shops of a similar kind were lighted differently according to their locality. They saw, for instance, all kinds of boot-shops in different districts. In a good neighbourhood the window would be dressed sparsely but neatly; while in another place where the people were of a poorer class, the shop-window would be found absolutely full of boots. The fact of there being so much black in the latter instance, would necessitate quite a different system of lighting from that required for the window in the better-class district. On the subject of "glare," there was one excellent example to which he might call their attention. Those of them who had occasion to pass Charing Cross Station would see that there was a small tobacconist's shop situated between one of the entrances to and one of the exits from the courtyard of the station. There was a space of about 14 feet between the two roadways; and this was occupied by the tobacconist's shop, which was lighted by several flame arc lamps placed about 2 ft. 6 in. apart. There being comparatively little light in the courtyard, the exits were practically dark; and this was a real source of danger when crossing the roadway, with the traffic going in and out of the station. Owing to the great glare of the arc lamps to which he had referred, and the darkness in the courtyard of the station, it was absolutely impossible to see anything coming out of the roadway. Mr. Carpenter had alluded to the ancient method of public lighting, when every householder was compelled to have a lamp outside his premises. It was the fact that the citizen would not always light this lamp, which led the municipality to undertake the work; and instead of lighting his own lamp, he had to pay others to do it. From this they had the system of public lighting as they knew it to-day. There could be no doubt whatever of the qualities possessed by gas from a hygienic point of view.

Mr. CHANDLER, in reply, said he felt he must thank Mr. Carpenter for the allusion he had made to the name which he (Mr. Chandler) bore. With the remarks which had been made on the subject of lighting the streets, he was in full agreement. He had noticed the difference between the illumination in side streets and in the main roads—with high and low pressure gas, electric flame and other arcs, and so on. Mr. Carpenter had suggested that a shopkeeper would wish to be different from other tradesmen in the matter of lighting; but really the choice of lamps was somewhat restricted—he meant in the matter of high-pressure lighting. Certainly, the fitter was a very important man indeed, who should be properly educated; and much was now being done to this end. As to builders' specifications, he had, of course, seen cases in which provision was made by the architect for carcassing for gas for lighting, but very seldom was heating included. What the gas suppliers wished was that the heating-points should also be arranged for when premises were being built. It was a fact that the lighting of shops varied a great deal, according to the district in which they were situated. The firm he had in mind when he wrote his paper were, indeed, the owners of boot-shops. They had shops in different districts; and their systems of lighting were chosen according to the neighbourhood in which the particular premises happened to be.

After the discussion, the author was cordially thanked, on the proposition of Mr. CARPENTER, seconded by Mr. BROWN.

UTILIZATION OF SPENT PURIFYING MATERIAL.

Simultaneous Extraction of Sulphur and Cyanides.

The specification has lately been published of a patent taken out for France by MM. Gouthière et Cie., in association with M. Pierre Ducancel, for a process for the simultaneous extraction of sulphur and cyanides from spent gas-purifying material. The following is a description of the process, which consists in the treatment of the material with neutral ammonium sulphide to form polysulphide.

When the mass has been filtered, the solution collected is subjected to the action of a current of steam, which decomposes the polysulphide, and precipitates the sulphur together with the ammonium sulphide, which is recovered. The residue left in the filter is at once diluted with water, and then treated with lime at boiling-point and out of contact with the air. It gives, when filtered, a residue formed of hydrated oxide of iron and sulphide of iron, which, when oxidized in air, produces a regenerated purifying material.

The spent purifying materials are mixed cold with a neutral solution of ammonium sulphide, which dissolves the sulphur in the condition of ammonium polysulphide. It also dissolves the sulphocyanides, and renders soluble a part of the prussian blue in the form of ammonium ferrocyanide. Moreover, it transforms the iron oxide into sulphide, with fixation of ammonia, and very probably forms a double sulphide of iron and ammonium.

By filtering the mass obtained, there is collected a solution formed of ammonium polysulphide, ferrocyanides, and sulphocyanides; the residue in the filter being solid, and containing iron sulphide, sulphate of lime, sawdust, and the portion of the prussian blue not rendered soluble by the ammonium sulphide. The solution and the residue are then treated separately.

The former is subjected to the action of a current of steam, which carries away the ammonium sulphide, the greater part of which is recovered, and can be utilized for a fresh operation The liquid remaining is composed of ferrocyanide and sulphocyanide, and holds in suspension precipitated sulphur, which is separated by filtration. The solid residue is immediately diluted with water, or, better still, with the residual liquid separated from the precipitated sulphur. The mass is then treated, boiling, with lime. By this treatment, the ammonia from the ferrocyanide, the ammonium sulphocyanide, and the double sulphide of iron and ammonium are liberated and collected by the usual methods. At the same time the last portions of prussian blue, not extracted from the residue by the ammonium sulphide, are rendered soluble in the form of calcium ferrocyanide, with precipitation of hydrated oxide of iron.

It is of the greatest importance not to expose to the air the residue from the polysulphide solution, and to dilute it immediately with water; otherwise the double sulphide of iron and ammonium it contains would be rapidly oxidized, and produce iron oxide, sulphur, and a disengagement of ammonia which would be lost. On the other hand, the sulphur formed would give, in the presence of lime and prussian blue, sulphocyanides, which would decrease the yield of ferrocyanide. To prevent the action of the air, the operations described are carried on in closed vessels furnished with mechanical mixers and heating-worms. With the same object, care must be taken to utilize as filtering apparatus filter-presses and mechanical filters with collectors in the lower part, as by so doing all emanation that might otherwise take place can be avoided.

The material remaining after treatment with lime is filtered, and yields a solution containing ferrocyanides and calcium sulphocyanides, which are extracted by the ordinary methods, and a residue containing a hydrated iron oxide precipitate, iron sulphide, sawdust, &c. The mass is allowed to oxidize in the air, and a regenerated material is obtained which can be employed again for the purification of gas. A portion of the precipitated sulphur is transformed into steam, then combined with hydrogen, preferably in the nascent state (obtained, for example, from water gas), to form hydrosulphuric acid. This acid is absorbed by the ammoniacal solution resulting from the lime treatment, and gives neutral ammonium sulphide. Thus the fraction of this substance which had been decomposed by the oxide of iron is recovered. It is added to the portion already obtained from the decomposition of the solution of polysulphide, and used for treating another quantity of spent material.

Continuous Wood-Stave Pipe.

Continuous wood-stave pipe is employed for the supply lines of the water-works system of Denver (Colo.); and the following notes regarding their use are taken from a paper entitled "Some Water Supply Problems Encountered in the Semi-Arid Regions of the United States," recently presented to the New England Water-Works Association by Mr. Clarence Goldsmith. All the pipes are cross-connected, and the flow through each is recorded by a Venturi meter. The oldest of the longer lines was installed in 1890, and has a length of about 18 miles, in the course of which there is 44-feet fall. The line shows a carrying capacity by meter measurement of 8 million gallons per day. There are three other lines of similar length—a 30-inch and a 34-inch line having a capacity of 13 million gallons, a 40-inch line with a capacity of 23 million gallons, and a 44-inch and a 48-inch line having a capacity of 25 million gallons. The continuous wood-stave pipe has proved to be well adapted for conduit lines, as the expense of installation is much less than that of steel or of cast iron, due not only to the lower cost of material, but also to the greater ease with which it can be transported, particularly to points difficult of access. In applying the Hazen-Williams formula, Mr. Goldsmith believes that a co-efficient of 125 may be used safely in making calculations; and he states that there are several lines which show co-efficients as high as 140. The wood of which the pipes are composed is reported to have a very long life; but the bands, which are the first to fail, generally last about twenty-five years, depending upon the quality of the original material, their coating, the care with which they were installed, and the nature of the soil. Experience has shown, according to Mr. Goldsmith, that a rolled thread is preferable to a machine-cut thread.

Miss Brenda Mackenzie, the only daughter of Mr. J. M. Macmorran, the Secretary of the Primitiva Gas Company, of Buenos Aires, Limited, was married last Wednesday, at St. Peter's, Eaton Square, to Mr. John H. Bennett, younger son of Mr. A. Bennett, of Goring.

Before the Bournemouth Natural Science Society, on the 30th ult., Mr. Samuel Wood, F.C.A., who is known to a number of our readers from his old connection with the firm of Messrs. Wood, Drew, and Co., delivered an interesting lecture on "Morocco of the Past and of To-Day." It was historical and geographical, and based on the personal observation of the lecturer, who has visited Morocco several times. It was illustrated by lantern pictures of the country and its people prepared from views taken by him; and was brought to a close by a series of interesting descriptions of Moorish manners. The lecture was so successful that Mr. Wood has been requested to repeat it, on some date convenient to himself, in the autumn.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Private Bills last week :—

Bills read a second time and committed: Annfield Plain and District Gas Bill; Church Stretton Urban District Water Bill; Dunstable Gas and Water Bill; Egremont Urban District Water Bill; Fleetwood Gas Bill; Windermere Gas and Water Bill.

Bill reported: South Suburban Gas Bill.

The opposition to the North Middlesex Gas Company Bill was withdrawn and the Bill was referred to the Unopposed Bills Committee—to meet to-day (Tuesday).

It was resolved that no Private Bill brought from the House of Commons shall be read a second time after Thursday, July 4; and that no Provisional Order Confirmation Bill originating in the House of Lords shall be read a first time after next Tuesday, the 7th inst.

HOUSE OF COMMONS.

The following further progress was made with Private Bills last week :—

Bills reported: Ashbourne Urban District Council (Gas) Bill; Belfast Corporation Bill (Lords); Ivybridge Urban District Water Bill; Leatherhead Gas Bill; Tavistock Urban District Council Bill.

A petition for additional provisions in the Scunthorpe Urban District Water Bill was referred to the Examiners.

A Bill "to enable local authorities to relieve ratepayers from paying rates in respect of buildings and fixed plant and improvements, and to adopt land value as the standard of rating, was read the first time on Wednesday last.

The Suggested Royal Commission on Co-Partnership.

A fortnight ago, Lord Robert Cecil asked the Prime Minister what decision the Government had come to with regard to the memorial asking for the appointment of a Royal Commission on co-partnership. Mr. Asquith promised to look into the matter, and asked that the question should be repeated a little later. Accordingly, Lord Robert Cecil gave notice that he would put the question again on April 25; and it received attention with other queries on the same subject—one being by Mr. G. Terrell, who inquired whether, in view of the importance of dealing promptly with organized national strikes, the Government would now appoint a Commission to inquire into the question of industrial unrest and its causes.

In reply, the Chancellor of the Exchequer said the problem of industrial unrest in all its aspects was receiving the careful consideration of the Cabinet. They recognized the importance of an investigation into the question of co-partnership; but, as at present advised, the Government did not think that the question should be treated as an isolated part of the problem, and they were not satisfied that the appointment of a Royal Commission was the best method of dealing with the matter. They would, he hoped, be able to give an answer in the course of two or three weeks.

THE "CHEMICAL CLAUSE" AND UNOPPOSED BILLS.

In two Bills which came before the Unopposed Committee of the House of Commons last Thursday, discussion took place in connection with clauses dealing with residual products.

BELFAST CORPORATION BILL.

This is a Bill to confer further powers upon the Corporation of Belfast in respect of their gas undertaking, and authorizes the borrowing of £400,000 for additional lands and works. The estimates are as follows: Retorts, machinery, and buildings, £176,000; purifiers, £20,000; gasholders, £110,000; coal and coke handling plant, £15,000; chemical plant, £40,000.

Mr. CRIPPS (Messrs. Dyson and Co., Parliamentary Agents) having explained the provisions of the Bill,

Mr. E. MOON (the Speaker's Counsel) called special attention to clause 6, which deals with the question of residual products, and which is set out in full below as it appeared in the filled-in Bill.

CLAUSE 6.

(1) Subject to the provisions hereinafter in this section contained, the Corporation may, upon the lands described in the schedule to this Act, erect gas-works and buildings and make, construct, lay down, and maintain, either separately or as part of their gas undertaking, retorts, gasometers, receivers, mains, pipes, machinery, and other works and apparatus, and may on the said lands manufacture, produce, convert, and store gas, and may manufacture, produce, convert, store, and sell or dispose of, residual substances, liquids, and products arising in the manufacture of gas.

(2) The Corporation shall not, under the powers of this Act, use the lands described in Part I. of the schedule to this Act for the manufacture or storage of gas, but may use the same for carrying on any process of manufacture of, or dealing with, any residual substances, liquids, or products arising in, or incidental to, the manufacture of gas or the manufacture of or dealing with residual products, and also for storing any such residual substances, liquids, or products other than waste materials: Provided that any works or apparatus provided for the purpose of this subsection shall be constructed as far as practicable from Cromac Street.

(3) The Corporation shall not, under the powers of this Act, use the said lands described in Part II. of the said schedule for erecting more than one gasometer, or for erecting any buildings for the manufacture of gas other than purifying plant and governor or meter houses. Such gasometer shall not be erected so as to be within a line drawn parallel to, and at a distance of 80 feet from, the southern side of McAuley Street, as shown upon the deposited plans, nor shall the lands northward of the said line be so used for a storage place for coal, or for the deposit of offensive materials or for the erection of purifying plant or other works or plant used for the manufacture of gas.

Mr. MOON suggested the insertion of the words "by them" after the words "manufacture of gas" at the end of sub-section (1), as he presumed the Corporation desired only to deal in their own residual products. Did they wish to buy residual products from other gas undertakings and work them up for sale?

Mr. CRIPPS said this latter point had not been considered by the Corporation; but he feared that the insertion of the words proposed would restrict their powers very much.

The CHAIRMAN (Mr. Whitley) pointed out that the alteration proposed would not restrict the Corporation from purchasing any chemicals necessary for working-up their own residual products; and he did not think any harm would be done by inserting the words suggested.

Mr. CRIPPS said the alteration would put a limitation upon the undertaking which at present did not exist, and which was not asked for by any petitioner. He saw no reason why the Corporation should not be allowed to purchase tar, for instance, from other undertakings so long as they were using their own tar as well. The clause had been settled after some difficulty with those who would otherwise have opposed.

Mr. MOON pointed out that, under the clause as it was in the Bill, the Corporation could enter into competition with chemical manufacturers; and he understood they did not desire to do this.

The CHAIRMAN followed this up by remarking that at one time gas undertakings found themselves getting into the hands of the chemical manufacturers rather too much, and certain powers were given them which relieved them of this handicap. At present, however, he thought the tendency was to go rather in the other direction.

Mr. CRIPPS, in the course of further discussion, said he foresaw difficulties arising in dealing with their own residual products, due to the suggested alteration in the wording, which the Committee did not realize.

The Committee, however, decided to insert the words "by them" in the position indicated above.

The Bill was then reported for third reading.

LEATHERHEAD GAS BILL.

A "chemical clause" was also inserted in the Bill promoted by the Leatherhead Gas and Lighting Company.

Mr. *E. H. Stevenson* having proved the preamble of the Bill,

Mr. F. J. CROWTHERS (Messrs. Hargreaves and Crowthers, Parliamentary Agents) said that the Lord Chairman had asked for the insertion of the following "chemical clause." The Company saw no objection if the Committee desired it to go in. The clause (44a) reads:

> Notwithstanding anything contained in the Act of 1899, the Act of 1901, the Order of 1903, or this Act, the Company shall not purchase for use in any process of manufacture any materials other than those required for the making and supply of gas by them, or for the working-up of their own residual products, or for the construction, maintenance, and repair of their gas-works plant and buildings or of gas-fittings.

Mr. MOON: The clause may as well go in. You do not want to manufacture chemicals.

Mr. CROWTHERS: No.

The CHAIRMAN said that if the promoters had asked him not to insert the clause, he should have met their wishes. The matter had been fought out already before Committees of both Houses; and there was a difference of one word between the clauses inserted in the two cases.

Mr. MOON said there was going to be a big fight over that word "for."

The clause was inserted, and the Bill was reported for third reading.

YORK UNITED GAS BILL.

HOUSE OF LORDS COMMITTEE—Thursday, April 25.

(*Before Lord* BARNARD, *Chairman*, *Lord* FALKLAND, *Lord* BRABOURNE, *Lord* AMHERST, *and Lord* ORANMORE AND BROWNE.)

The objects of this Bill are to consolidate the existing Acts of the York United Gas Company, and incidentally to repeal old and effete provisions; to extend the limits of supply; to sanction additional lands, and the uses thereof for gas purposes; to authorize additional capital; to change the Company from a maximum-price to a sliding-scale concern; to reduce the illuminating power of the gas supplied by the Company; and to apply various modern provisions now usually found in Gas Acts, including the modern testing-burner.

Counsel for the Bill were Mr. HONORATUS LLOYD, K.C., Mr. C. C. HUTCHINSON, K.C., and Mr. S. RAIKES. The opponents were the United Alkali Manufacturers' Association, represented by Mr. J. D. FITZGERALD, K.C., and Mr. LYNDEN MACASSEY; the York Corporation, by Mr. J. D. FITZGERALD, K.C., and Mr. F. T. V. BAYLEY; owners and occupiers in the neighbourhood of the works and proposed new lands, by Mr. G. W. BAILEY, Mr. C. E. ALLEN, and Mr. FRERE (Parliamentary Agent).

Mr. HONORATUS LLOYD, in opening the Bill, gave, briefly, the history of the Company, which dated back to the year 1844, when an Act was passed amalgamating two existing undertakings which were supplying York. One of these was a statutory concern, which came into being

under an Act of Parliament of 1823, and the other was a non-statutory Company, which came into existence under a Deed of Settlement in the year 1837. The Act of 1844, which amalgamated the two Companies and brought into existence the present Company, sanctioned the present works of the York United Gas Company. The capital of the Company at the date of the amalgamation was £75,000, with a 10 per cent. maximum dividend, and £25,000 loan capital, which the Company were entitled to raise as ordinary capital, and which they did, in fact, raise as ordinary capital. Thus the total capital raised under the Act of 1844 was £100,000. Of this, £50,000 was allotted to the shareholders in the old Companies as consideration for purchase by the new Company, and the remainder was available for the ordinary purposes of the Company. In 1878, the Company were again in Parliament, and obtained additional capital powers to the extent of £80,000 of 5 per cent. capital, and £20,000 of loan capital. The maximum price was fixed at 3s. 6d. per 1000 cubic feet for gas supplied within a radius of two miles from a certain bridge in the centre of York; and 4s. was the maximum price beyond that limit. Gas of 14-candle power was supplied in 1878; and the test was made with Sugg's No. 1 argand burner. All the capital of the Company was raised and expended; and in 1898 they were again before Parliament, when they took the opportunity of asking for the conversion of their capital into one kind of stock, instead of the existing varying classes of shares. Parliament authorized the conversion of the £100,000 of 10 per cent. capital into £250,000 of 4 per cent. stock, which gave the same return, and also the conversion of the £80,000 of 5 per cent. capital into £100,000 of 4 per cent.; thus giving one class of £350,000 of 4 per cent. stock. The Act of 1898 also provided for additional capital to the extent of a further £80,000, and prescribed a maximum dividend of 4 per cent. Borrowing powers to the extent of £20,000 were also granted under the Act of 1898. The maximum price prescribed in the earlier Acts was repealed and re-enacted. It was originally 3s. 6d. within a radius of two miles of a certain bridge, and higher outside this radius. The Act of 1898, however, re-enacted that the price should be 3s. 6d. whether within or outside this radius. The quality of the gas was increased from 14-candle power to 15½-candle power. The capital authorized in 1898 had been issued to the extent of £50,000 as 4 per cent. preference stock, which the Company were entitled to do, and £20,000 ordinary 4 per cent. stock; the remaining £10,000 of the £80,000 authorized in 1898 not having yet been raised. This was because, unfortunately, when they anticipated that they would be able to run on a 4 per cent. basis, they made a mistake. The records of gas companies showed that it was impossible to raise ordinary capital at par on a 4 per cent. basis. Thus the £10,000 still remained unissued; and under the present Bill, it was proposed that it should be cancelled and taken into account in respect of the additional capital now asked for. There was also £5000 loan capital still unissued, on account of the £10,000 ordinary capital not having yet been raised. Therefore, under the Act of 1898, of the £80,000 share capital thus authorized, £70,000 had been issued; and of the £20,000 loan capital authorized, £15,000 had been issued—making £85,000 in all under the Act. Since then the sum of £9418 had been spent on the undertaking; and to this extent the Company were overdrawn upon capital account. With regard to the extension of the limits of supply, it was found that the districts round about the City of York were rapidly developing; and it was proposed to include an area having a radius of seven miles from the centre of York. Although it was proposed under the Bill to take further lands, the requirements of the undertaking did not call for additional works immediately; but the Company thought it would be a more economical course, as they now had a Bill in Parliament, to apply for sanction to these lands, which they would undoubtedly require in the near future. The present area owned by the Company was about five acres; and the new lands were about four acres. The new capital proposals were such as the Company thought would carry the undertaking on for the ordinary period of from twelve to fourteen years. The sum of £80,000 share capital was asked for, with the usual one-third borrowing powers in respect of the new capital, in addition to one-third borrowing powers on the original capital. Thus the total new capital was £80,000 in shares, *plus* £41,666 in loan capital—making a total of £121,666. The next object of the Bill was the adoption of the sliding-scale principle instead of the maximum-price principle. In this connection, of course, it was necessary to give attention to the standard price and standard dividend proposed, in order that a fair basis might be adopted. Under the Bill originally, 2s. 10d. was asked as the standard price; this figure being arrived at as a mean between the 3s. 6d. maximum price now existing and 2s. 2d., the actual price at which gas was sold. Why this was adopted he did not know, because when it came into the hands of those who were accustomed to dealing with these matters, attention was at once called to the fact that this was not the principle adopted. The principle was really this: Parliament usually ascertained just what was a fair price, having regard to the cost of generation or manufacture and distribution, and what was likely to be a fair cost over a period of years, and also the cost of capital, in order to arrive at a fair standard price. It was also necessary to bear in mind what was the actual price charged. The present price was 2s. 2d.; but it had been down to 1s. 11d. When it was at the latter price, however, it was now clear that in these years insufficient money had been spent upon the works to keep them in proper repair, and, in addition, the undertaking was not in reality earning sufficient to pay the dividend which was actually distributed. Under all the circumstances, therefore, it was now proposed to ask the Committee to adopt the 2s. 6d., which had been inserted in the filled-in Bill, instead of the 2s. 10d. The reasons for having a higher maximum than the present actual price charged were manifold. Those interested in the gas industry had to contend with conditions—some of them in common with other industries, and some of them peculiar to the gas industry. One of the things to be considered was labour; and the cost of this had gone up at the Company's works by between £800 and £900 during the last year. In addition, they had to face the almost certainty of a gradual increase in the price of coal. They did not like the prospect of coal; for they had reason to believe that, once having gone up under abnormal circumstances, it was not likely to come down to the price at which it started to rise. They therefore looked forward to having to pay more in future for coal. Then they had the Insurance Act to face, which was going to put a substantial expenditure upon the Company. Under all these circumstances, the Company felt that it would not be politic to maintain the 2s. 2d. price, and that 2s. 6d. would probably give a fair margin of safety, having regard to the matters he had mentioned. With reference to the standard dividend, the Company were asking the Committee to adhere to 4 per cent. on the existing consolidated stock, and allow a standard of 7 per cent. on the new capital. He did not think it could be said that this was anything beyond what was ordinary, because, although 7 per cent. might seem high compared with the standard of 4 per cent. on the existing stock, the conditions were very different. The Company found they made a mistake in suggesting 4 per cent. for the existing capital, which they could not raise now. The 7 per cent. capital would be subject to the auction clauses; and the higher the standard dividend prescribed, the higher the price that was reached when the auction clause was exercised. They were anxious to get the best price possible for the shares on the market, which was in the interests of everybody; for, under the auction clauses, all the premiums brought in on the issued stock helped to reach the total to which they were limited, and was included in the new capital, and bore no interest whatever. As to the amount of increment allowed in respect of the sliding-scale, it was asked that, in respect of the existing 4 per cent. consolidated capital, the decrease or increase should be 2s. per cent. for every penny up or down in the actual price; and in respect of the 7 per cent., the correlative figure of 3s. 6d. per cent. for every penny increase or decrease. These figures were in accordance with ordinary practice. Dealing with the proposed reduction of illuminating power, Counsel recalled the attitude of the local authorities towards the companies when the proposal to reduce the illuminating power was first brought forward; but the feeling that this movement was a new form of rapacity on the part of the Company at the expense of the consumers had practically died out. It had now become the almost uniform practice to fix a candle power of 14. At the same time, he believed that in this case it was thought that the Company were making a saving at the expense of the consumers; but in fixing the standard price asked for, the Company had taken this into account, just as they had taken into account the elements which told against them. Again, in connection with the adoption of the new test-burner, he did not think this would be opposed; but it might be said that the Company made a saving. Here, again, consideration had been given to this in fixing the standard price. Further, the Company were prepared, with a view to obtaining peace and satisfying their consumers, to go even further. Mr. Corbet Woodall was prepared to advise the Company that they could accept not only a 2s. 6d. standard price, but could agree to a neutral zone as between 2s. 6d., the proposed standard price, and 2s. 2d., the present selling price—*i.e.*, that as between 2s. 2d. and 2s. 6d. there would be no change in the dividend, the Company having this 4d. to cover the contingencies which he had mentioned, but not being allowed to divide any higher dividend by reason of the reduction between these points.

The CHAIRMAN: This is new.

Mr. HONORATUS LLOYD: Yes; it is not in the Bill. Mr. Corbet Woodall, however, advises me that he thinks the Company can do this; and I thought it right to place it before the Committee at the earliest possible moment.

Counsel then went on to deal with the petition of the York Corporation, who submitted that the undertaking should be transferred to them on reasonable terms, and that the present Bill should not go forward, as it would enhance the value of the undertaking and increase the price which the Corporation might have to pay for it in the future, when they made up their minds to purchase. He could not help thinking that this suggestion originated in Westminster, because the Corporation had consulted a well-known gentleman; and he saw from the public Press that his first suggestion had been that they should purchase the undertaking. The proper way was for the Corporation to present a Bill, to which they must get the consent of their ratepayers. This had not been done; and apparently they wanted a suspensory purchase clause to be hung over the heads of the Company. Already the Corporation were proprietors of the electricity undertaking, and were carrying on a very brisk competition; and it certainly seemed, in the interests of the ratepayers and the consumers of both gas and electricity, that this competition should continue. At the same time, he felt bound to point out that the working of the electricity undertaking had not been so successful as the gas undertaking, because there had been a loss upon it of £7000 in thirteen years; whereas the Gas Company had been paying their maximum dividend for many years. As to extending the limits of supply, the Corporation stated in their petition that the bulk of the area scheduled was agricultural land, and that the only two places desiring a supply of gas were Haxby and Wiggington, both of them to the north of York. The new capital powers were said to be excessive, and should be limited to an amount only sufficient for carrying on the undertaking for the next few years. It was also asked that no capital should be authorized higher than 5 per cent., and preferably 4 per cent. But the result of this suggestion would be disaster to the Company, because, as he had already pointed out, they could not raise capital at par upon these terms. The appointment of an independent auditor was also asked. In regard to the reduction of the illuminating power, he agreed that a fair criticism was made—namely, that it would render necessary new burners, and that these should be provided free of charge. An alteration to this effect had been made in the Bill. Petitions against the Bill had also been presented by owners, lessees, and occupiers in the neighbourhood of the existing works and proposed new lands. But out of 691 notices served upon persons entitled to receive them, petitions had been presented only on behalf of 41. The main point of this opposition was possible nuisance from the works; but even the Corporation, who did not seem to have missed much in their petition, had not raised this point. The Company were not asking for powers to treat residuals on the new lands. Finally, there was the opposition of the United Alkali Manufacturers' Association. This was part of a policy which this body were pursuing in the present session of Parliament in both Houses. [Counsel then explained the circumstances of the South Suburban, the Annfield Plain, and the Fleetwood Gas Bills, which have already been reported at length in our columns.] He drew the attention of the Committee to the fact that, in

inserting the clause in the Annfield Plain Bill, the House of Commons Committee specifically mentioned that it was not to be regarded as a precedent, and that other circumstances in other Bills might arise which would render such a clause unnecessary. In the case of the South Suburban Bill, Lord Ritchie, who was the Chairman of the Committee, did not make any observation; but he put in a clause which presumably applied to that particular case only. He would submit that in the present case there was no reason for inserting such a clause. Apparently the Association wished to set up a monopoly, in order to keep up the process of certain commodities—an action which he desired to protest against, and upon which he would give his evidence.

Mr. *A. Procter*, a Director of the Company, was the first witness, and confirmed all the statements made in the opening speech.

In cross-examination by Mr. J. D. FITZGERALD, on behalf of the United Alkali Manufacturers' Association, on lines already familiar to our readers—namely, that the objection of the Association is to gas undertakings, not being content with working-up their own residuals, but purchasing residuals from other undertakings, and generally turning themselves into chemical manufacturers in competition with private traders—witness said he would not agree to the insertion of the clause which the Association secured in the South Suburban Gas Bill, as, although they were not at present treating their residuals in the manner objected to, he did not wish to tie the hands of the Company for the future.

Mr. FITZGERALD: Really then you are not objecting in your own interest, but in the interests of a large number of other gas companies who are carrying on this business.

Witness: Oh, no. We have had no communications from other gas companies.

Then it seems difficult to understand the reason of your objection, unless you have the intention of doing in future what we regard as an objectionable thing?—We have no intention at present.

Then I do not see how it can hurt you.

Witness was then cross-examined by Mr. FITZGERALD on behalf of the York Corporation. Counsel hinted that the attitude of the Gas Company towards their consumers in the past had not been fair, and that the present Bill was also unfair to the consumers, as the reduction in candle power would reduce the cost of manufacture, and the Company were taking the whole benefit of this. Similarly, he suggested that the whole benefit of the change of testing-burner was being taken by the Company. In both instances, however, witness disagreed, for the reason that other expenses were showing a distinct tendency to increase. Counsel also put it to witness that in 1899, when the Company were selling gas at 1s. 11d. per 1000 cubic feet, the price of coal was higher than it is to-day, and he failed to see any justification for keeping the price at the present figure. Witness answered that the Company were advised that the present price is a proper one in relation to the cost of production. On the question of purchase, witness said the Company did not desire to transfer their undertaking to the Corporation. Counsel, however, wished to know what harm would be done to the shareholders by a transfer if they received the full value of the undertaking.

Cross-examination was continued on behalf of the various occupiers, &c, of property near the works—each endeavouring to secure a promise from the witness that a clause would be inserted giving them compensation in the event of depreciation of the property. This was refused in every case.

Mr. *H. R. Moiser*, a tenant of property quite close to the gas-works, was called to testify that no nuisance had ever been experienced from them.

Friday, April 26.

A good portion of the morning was occupied with hearing evidence from residents in the proposed extended area as to the need for a supply of gas in these districts.

Mr. *W. Cash* gave the financial details of the Company. The net cost of gas sold in 1910 was 17·63d. per 1000 cubic feet, after deducting revenue from meters and fittings. In 1911, the figure was 17·31d. Capital charges were 8·59d. and 8·6d. respectively in the two years mentioned—making totals of 26·2d. and 25·91d. He supported the proposal to make the new capital 7 per cent. stock. He knew of no case where the consumers had been injured by such priced stock. During the five years 1905 to 1909, the Company had set aside depreciation on stoves, cookers, &c., supplied by prepayment meters to the extent of half the extra money received through these meters; but this was not sufficient in his opinion. In his calculations for the purposes of the Bill, he had taken a larger amount. He had added 0·56d. and 0·62d. for the years 1910 and 1911 respectively. The present average price was about 2s. 1½d. He thoroughly endorsed Mr. Woodall's suggestion of a neutral zone between 2s. 2d. and 2s. 6d. during which the sliding-scale should not operate. The operation of the Insurance Act would involve an extra annual expenditure of £160, equal to 0·08d. per 1000 cubic feet on the present consumption. A reduction of a penny in the selling price resulted in £2100 going to the consumer and £370 to the shareholders. He had looked into the accounts of the Corporation electricity undertaking, and agreed that this had not been particularly successful.

In cross-examination on behalf of the York Corporation, Mr. FITZGERALD reminded witness that the electricity undertaking was being judged after it had paid interest and sinking fund, which latter the gas undertaking did not have to bear. Last year, he said, the undertaking, on the basis of a company, earned sufficient to pay 7 per cent. Witness replied that this was only one year out of thirteen years.

The CHAIRMAN wished to know why the electricity undertaking had been introduced into the discussion.

Mr. HONORATUS LLOYD replied that the Corporation had stated it would be to the advantage of the ratepayers if the gas undertaking were in their control; and he desired to show that they had one undertaking which appeared to be sufficient for the present.

Mr. FITZGERALD said this apparently suggested that the Corporation were incapable of carrying on an undertaking of this kind.

Mr. HONORATUS LLOYD: I do not say the Corporation are incapable. They do their best; but it is not good.

Mr. FITZGERALD continued his cross-examination, directing himself at length to the point that the Company at any rate during the past two years, had been charging stoves, meters, cookers, &c., to revenue and not to capital—thus depriving the consumers of reductions in price to which they were clearly entitled.

Mr. HONORATUS LLOYD pointed out that, in the case of local authorities, the Local Government Board refused to allow these short-life items to be charged to capital.

Mr. FITZGERALD also argued that the existing reserve fund should be applied to the special purposes fund proposed under the Bill. But the reply was that this would have the effect of preventing the existing reserve fund being used for the equalization of dividends, which was its present purpose.

Mr. *Corbet Woodall* expressed the opinion that 2s. 4d. would be a reasonable standard; but having regard to the uncertainty in the items referred to by Mr. Honoratus Lloyd in his opening speech, he felt that the neutral zone between 2s. 2d. and 2s. 6d. was the best way out of the difficulty. He had adopted this plan with success in other cases. The increase in all gas undertakings had been very small during recent years; electric supply having cut heavily into the business. Gas companies were therefore well advised in seeking wider areas of supply. The average increase of the York Company during the past few years had been 1 per cent. per annum; and he thought that 2½ per cent. per annum would be a fair rate of increase to assume for the future if the new area were allowed. The present capital expenditure at York was £600 per million. Witness was preparing to deal with the question of candle power proposed under the Bill, when

Mr. FITZGERALD interposed with the remark that he was not taking any objection to the actual diminution, provided proper effect was given to it in the price.

Witness said that the proposals under this head in the Bill were in accordance with modern parliamentary practice; and full consideration had been given to all the elements involved in arriving at the price. With regard to the proposed purchase by the Corporation, it was not fair to compulsorily expropriate a company when there was no real ground for complaint; and there was certainly none in regard to the York undertaking. As to the petition of the Alkali Manufacturers' Association, he first of all pointed out that there was no intention on the part of the York Company to embark upon the business of chemical manufacturers; but he saw no reason why a limitation should be placed upon gas companies from purchasing residuals from other companies. It would be a hardship on the small companies particularly, because such companies as the York Company would then not be able to sell their residuals to the larger companies. Further, he deprecated very strongly putting in such clauses, especially in unnecessary cases, as the cumulative effect of them was to create precedents, which handicapped the industry very considerably. If chemical manufacturers felt they required further protection, they should endeavour to get it inserted in the Gas-Works Clauses Act.

Mr. FITZGERALD cross-examined for the Alkali Manufacturers' Association. Witness agreed that the Gaslight and Coke Company, in the working-up of their residuals, found themselves with a considerable quantity of sulphuric acid upon their hands, which it was their practice to sell; their revenue from this source being some £2000 a year. According to the proposals of the Alkali Manufacturers' Association, they could not sell this to another gas company. Mr. Fitzgerald repeated the arguments which have now become well known, that the object of the Association was not to prevent gas undertakings from selling their own residual products, but to prevent them purchasing the residual products of other undertakings, and from buying chemicals in the open market and setting up as chemical manufacturers. Witness said he did not see any probability of the York Gas Company doing anything of the sort. In his opinion, a more useful course of action for the United Alkali Manufacturers' Association would be to confine their attention to the companies who were doing what they were complaining of, and not to attack those who were not.

Mr. FITZGERALD then cross-examined witness on behalf of the York Corporation, and dealt with the question of purchase.

The CHAIRMAN interrupted, and stated that, in his opinion, this was a purely hypothetical question; and so far as he had considered the matter at present, he hardly thought it was before the Committee. It was true that the point had been raised in the petition of the Corporation; but, on the other hand, it did not seem that it was a matter which had been seriously considered by the Corporation.

Mr. FITZGERALD said his object in raising the question was to prevent the value of the undertaking being enhanced by any proposals in the present Bill—assuming that the Corporation desired to purchase (say) next year.

The CHAIRMAN said, of course, the Committee would be bound to hear what Mr. Fitzgerald had to say with regard to this matter. At another point in the cross-examination, which dealt with the proposed 7 per cent. stock, he suggested to Mr. Fitzgerald that he would have to prove a serious objection to 7 per cent. stock if the Committee were to alter it. He did not think it mattered one way or the other; and if the Company desired 7 per cent. stock, speaking for himself, he thought they might have it.

The cross-examination of Mr. Woodall on behalf of the occupiers and owners of premises in the neighbourhood of the works and new lands suggested that the whole of the present works should be transferred to a site beyond the present residential area; but it was clear that this was hardly a course which commended itself to the Committee—the Chairman once remarking that this seemed to be a very expensive matter.

The Committee then adjourned till yesterday (Monday).

Monday, April 29.

Evidence was given to-day on behalf of the Bill by Mr. Harry Woodall and Mr. J. H. Hill, the Manager and Secretary of the Company. This closed the case for the promoters; and the opposition of the forty-one owners, lessees, and occupiers (represented by Mr. Bailey) was proceeded with. A witness on behalf of these petitioners stated that, in connection with the manufacture of water gas, explosions

occurred which blew slates off the roofs of the Company's buildings, sending forth fumes and flames "to a height of 50 feet." The case for two individual owners who appear separately by Counsel was also heard—leaving the opposition of the York Corporation and the United Alkali Manufacturers' Association still to be taken.

STAFFORDSHIRE POTTERIES WATER BILL.

House of Commons Committee.—Monday, April 22.

(*Before Sir* E. Cornwall, *Chairman, Mr.* Boyton, *Mr.* Fitzherbert Wright, *and Mr.* M'Callum Scott.)

This is a Bill to sanction and confirm the construction of certain water-works by the Staffordshire Potteries Water Company; and to empower the Company to construct and maintain further works, acquire lands and waters, extend their limits of supply, and raise additional capital.

Mr. Honoratus Lloyd, K.C., Mr. C. C. Hutchinson, K.C., and Mr. Courthope Munroe appeared for the promoters.

Mr. Honoratus Lloyd said the Bill was promoted by the Staffordshire Potteries Water Company, and originally there were against it seven petitions, six of which had been withdrawn; and there was only one question in dispute. The main objects of the Bill were to enable the Company to construct additional works, to confirm certain existing works, to enlarge the limits of supply to a small extent, to authorize the raising of additional capital, and to repeal certain provisions of an existing Act. The Company was incorporated under an Act passed in 1847. Two years later a substituted Act was passed which repealed the former one; and in 1853 a third Act repealed both its predecessors. Further Acts of 1861 and 1868 conferred additional powers; and the last Act, obtained in 1888, extended the Company's limits of supply to their present boundaries. The total capital authorized was £425,000 in shares and £125,000 on loan—making £550,000 in all; and of this amount £506,337 had been called up. The area of supply was 235 square miles in extent, and included the new county borough of Stoke-upon-Trent; and the population in the area was 324,100. Clause 6 of the Bill asked for confirmation of an existing pumping-station at Stockton Brook, a reservoir at Brown Edge, and an aqueduct which had been constructed upon land purchased by agreement. Until quite recently, it had been thought that water companies were entitled, under the Water-Works Clauses Act, to sink wells upon land which they had purchased in this way. In the recent case of the Frimley Water Company's Act, however, this point had been contested, and it had been held that a water company were not entitled to sink wells or construct works on lands without statutory authority for specifically doing so. Thus it was that the works referred to had been constructed under a misapprehension. The new works proposed were pumping-stations at Cresswell and Mill Meece, and a reservoir at Manchurch, in addition to aqueducts. The extension of limits proposed was to the Upper Tean and Checkley district (an area of three square miles, containing a population of 1200), at whose request the proposal was made. The additional capital powers asked for were £240,000. A limit of 7 per cent. was placed upon the capital if issued as ordinary, and 5 per cent. if issued as preference, stock, under the usual auction clauses. To all these proposals there was no opposition. The actual cost of the new works, according to the Engineer's estimates, would be £198,033; the difference between this sum and the £240,000 asked for being for the ordinary purposes of extensions of mains, &c. Coming to the one opposed portion of the Bill, Counsel explained the circumstances as follows: The Duke of Sutherland was the freeholder of the land upon which the Company's Wall Grange pumping-station was constructed, and, in addition, he was a large shareholder in the Company. Formerly, the main portion of the Company's water was drawn from the Wall Grange area; and, in these circumstances, the Duke had the right, under the early Acts, to appoint one Director of the Company. This position had endured until October last, when various portions of the Duke's estates were sold, including the Wall Grange estate. A portion of this, including the land upon which the pumping-station stood, was purchased by Mr. R. E. Bennison, who now claimed the right to appoint a Director as the Duke of Sutherland had previously done. In view of the fact that only a very small portion of the total supply was now taken from Wall Grange, the Company were asking for the sections of the early Acts to be repealed. As a matter of fact, Mr. Bennison did not know of the existence of this particular right at the time he purchased the estate, and only became aware of it by his attention being drawn to it by an official of the Company. Incidentally, it was mentioned that the Stoke-on-Trent Corporation were anxious to purchase the Company's undertaking, and would undoubtedly do so as soon as ever the time was opportune.

Mr. *G. B. H. Soame*, the Engineer to the Company, was called, and gave evidence in general support of the proposals of the Bill.

During his examination, it was announced by the Parliamentary Agent acting for Mr. Bennison that the promoters had agreed to accept a clause under which he was to receive a monetary consideration by way of compensation for the repeal of the sections of the Acts in dispute—the amount to be settled by arbitration, if no agreement were come to between the parties.

The Bill thereupon became unopposed; and the Committee proceeded to consider clauses.

The Chairman, in the course of the discussion, made some pointed remarks in relation to certain clauses inserted by agreement with the promoters, which, he said, placed certain people in a privileged position when they ought not to be. He was particularly concerned at a long clause inserted for the protection of the North Staffordshire Railway Company, which, among other things, included what is now known as a "bursting" clause, by which the Company agreed to pay compensation for any damage done by a burst water-main or aqueduct. The Chairman pointed out that the Railway Company had, in common with other ratepayers or members of the public, a remedy at common law; and he said he failed to see why special protection should be given.

Mr. Honoratus Lloyd stated that undoubtedly the Railway Company would fight the Bill in the next House if this protection were deleted by the Committee.

The Chairman said he did not think it was fair for promoters to agree with a Railway Company like this. If it were a clause put in to protect all the people within the limits of supply, he could understand it; but he did not see why Parliament should go out of its way to protect a great Railway Company who could well protect themselves at common law. He should certainly draw the attention of the authorities of the House to this matter. Incidentally, he expressed the opinion that all agreed clauses of this character in Private Bills should have an asterisk, indicating that the clause had not been considered by Parliament. He also pointed out that he was not objecting to the whole of the clause in question, but mainly to the particular portion to which he had drawn attention.

The remaining clauses were then adjusted; and the preamble of the Bill was passed.

FYLDE WATER BILL.

HOUSE OF COMMONS COMMITTEE.—Monday, April 22.

(*Before Sir* Charles Rose, *Chairman, Mr.* Stanier, *Mr.* Albert Smith, *and Mr.* Bird.)

On the resumption of the proceedings on this Bill [see *ante*, p. 237], the Committee were occupied for a good portion of the time in hearing evidence from estate agents and others practising in various parts of the area affected by the Bill, who testified to the increasing growth of housing accommodation as tending to support the estimates of future consumption prepared by the promoters.

Mr. Balfour Browne, K.C., Mr. Fitzgerald, K.C., and Mr. Tyldesley Jones, appeared for the promoters. The opponents were represented: Blackburn Corporation and West Riding County Council by Mr. C. C. Hutchinson, K.C., and Mr. Jeeves; Preston Corporation, by Mr. Vesey Knox, K.C., and Mr. Squarey; Ribble Conservators and Lancashire and Ribble Joint Committee, by Mr. Jeeves. Counsel were reserved by remaining opponents.

Mr. *John Cook*, Engineer to the Water Board, then gave evidence, and pointed out the reasons already given by previous witnesses why he selected the particular drainage area proposed in preference to any of the other possible sites nearer to the existing area which had been suggested by the opponents of the Bill. He said he had investigated the matter, and had reported to his Council to this effect as far back as July, 1909. His estimates of the new works proposed were as follows: Land, £142,909; reservoirs, £1,046,682; trunk mains, £367,928; road diversions, £23,891; and contingencies and engineering expenses, £158,140. The agreement with the riparian owners already referred to by Counsel for the promoters was to the effect that the first reservoir should be constructed within nine years.

In cross-examination, Mr. Vesey Knox drew attention to a report by the Board of Trade, in which it was suggested that the proposed works in the upper reaches of the River Ribble would interfere with the entrance to the dock at Preston. Witness declined to deal with this matter in detail, and preferred to leave it for the Board's own expert, who had gone into this aspect of the question. At the same time, he presumed that if any serious effects were produced, the Board would have to pay compensation. The cross-examination, continued at some length, was directed to showing that the Board's estimates and consumption in the future could not possibly be borne out.

Mr. Hutchinson, on behalf of the Blackburn Corporation, mentioned to the Committee that "conversations" were going on between his clients and the promoters; and therefore he proposed to leave for the present his cross-examination of the witness, in the hope that terms might be arranged, so far as Blackburn was concerned. On behalf of the West Riding County Council, he indicated some apprehension that lead poisoning would result from the use of the waters in the proposed area, which was of a peaty character, unless special precautions were taken. The Board would put their own chemist into the witness-box to deal with this matter.

Tuesday, April 23.

It was announced this morning that the opposition of the Blackburn Corporation was to be withdrawn on condition that the promoters cut out of the Bill all reference to the Croasdale reservoir. It has been agreed between the parties that the Croasdale area is to be left neutral territory. The case for the Blackburn Corporation is that Croasdale is the only area available to them for any extension of their existing drainage area, and which adjoins it, and that it will not be long before they will be compelled to come to Parliament for powers in this direction. The position now is that as the remaining portion of the area proposed in the Bill will suffice for the needs of the Fylde district for many years, Croasdale is not an essential portion of the present scheme, and is worth dropping in order to get rid of Blackburn's opposition. Thus either party may come to Parliament for powers in the Croasdale area as soon as their needs demand.

Further engineering evidence was given in support of the Bill by Mr. *H. Rofe* and Mr. *E. Mansergh*. Both were emphatic that the proposals form a good comprehensive scheme, and were of opinion that the estimates of future consumption were on the conservative side, and that the proposed site for the new works forms the only suitable area in this part of the Pennine Range. As to the possibilities of the present site, the latter witness expressed the opinion that the construction of the Grizedale Lea reservoir was a great mistake, and ought never to have been undertaken owing to the difficulties presented by the geological formation.

The opposition of Blackburn having been disposed of,

Mr. Vesey Knox, for the Preston Corporation, was forced to admit

that he had been going to rely upon certain figures in connection with the Brock area—suggested as a possible alternative—which had been prepared by the Blackburn Corporation. He was not prepared with this evidence himself, and would now rely on the assertion that a suitable area was available to the west of the Grizedale area in the valley of the River Wyre. It was brought out, however, that the Lancaster Corporation have certain powers in this district, which prevent the Fylde Board going there; while, in addition, the amount of water available would be very small. Mr. Rofe was reminded that he had once recommended this area, but he did not recollect having done so. Even if he had, he would not, with his present knowledge, take the responsibility of recommending it now. A period of twenty years is in the Bill for the completion of the whole scheme, with a limit of nine years for the first reservoir. The former period was, in Mr. Mansergh's opinion, too short, and not too long as has been suggested by the opposition. Mr. Mansergh also was very positive that the works proposed in the Bill could not conceivably interfere with the flow of water into the River Ribble so far as quantity is concerned; while as to velocity, owing to the works being so far away from the estuary of the Ribble, he did not anticipate any diminution greater than 2 or 3 per cent. Scouring action was not dependent upon land water, but upon the action of tidal water; and this, he said, could not be interfered with by the works proposed in the Bill.

Mr. *James Watson*, Water Engineer to the Corporation of Bradford, also gave evidence in favour of the scheme.

Wednesday, April 24.

When the proceedings were resumed this morning,

Mr. *J. N. Abernethey* and Mr. *G. E. Gregson* were called specially as to the suggested effect of the proposed works on the River Hodder upon the flow of water at the estuary of the River Ribble, and also upon the Preston Corporation's dock. These witnesses both stated that the estimated discharge of water at the estuary at an ordinary low tide was 119,110 cubic feet per minute, while the discharge of water on the Hodder, which the Bill would affect, only amounted to 4632 cubic feet per minute, which was $3\frac{3}{4}$ per cent. of the amount flowing at the estuary. Thus, any effect produced by abstracting this quantity of water—which, by the way, would be reduced by the amount of compensation water—must be infinitesimal.

Dr. *H. R. Milne*, the rainfall expert, gave results of readings which he has taken, showing that the average annual rainfall over the whole area proposed in the Bill was 34·2 inches.

Professor *Boyd Dawkins*, Professor of Geology at the University of Manchester, spoke as to the geological formation in the valley of the Hodder.

Professor *Sheridan Delepine*, Director of the Public Health Laboratory at the University of Manchester, was called to deal with the point raised by the West Riding County Council—that the waters from the River Hodder, coming as they do from moorland, will have a serious action on the lead service-pipes, and thus set up lead poisoning. The witness declared that he had analyzed the water there, and maintained that the plumbo-solvent action which this water would have upon the lead service-pipes was not greater than that produced by the water supply in a very large number of towns, and was much less than in many, where special precautions were not taken. Further, the Stocks reservoir would have a loam foundation; and this would reduce the effect which the water might have upon the service-pipes. As to the water from the Hodder area, 100,000 parts would only dissolve 0·14 to 0·16 part of lead in twenty-four hours.

In cross-examination by Mr. HUTCHINSON, for the West Riding County Council, witness agreed that the simple precaution of rejecting all the first waters given off after a heavy storm when dealing with peaty water lessened the effect upon the lead service-pipes; but there was no necessity for doing it in this case, in view of his analysis of the water. He saw no reason whatever why the West Riding County Council should have special powers of inspection in connection with this matter, as the risk was small. In Manchester, for instance, the water produced a similar effect on the service-pipes; but, though he had been living there many years, he had not yet been poisoned.

Mr. *C. Arthur* followed with evidence as to the possible amount of the rate-in-aid which the scheme might render necessary. He handed in tables showing that in 1914 a $1\frac{1}{2}$d. rate might be necessary, increasing to $6\frac{1}{4}$d. in 1922, after which it would gradually disappear.

This closed the case for the Bill.

Mr. VESEY KNOX then opened the case for the Preston Corporation, the outlines of which have already been indicated in his cross-examination of the witnesses. He laid great stress upon the fact that the Board of Trade had presented a report upon the Bill, in which they called attention to the possibility of damage being done to the dock at Preston by the reduction of the flow of water, and deprecating any such damage, in the interests of the port.

Thursday, April 25.

Practically the whole of to-day was taken up with the hearing of evidence on behalf of the Preston Corporation.

Mr. *James Barron*, the Engineer to the Preston Corporation, Mr. *G. Lyster*, the Engineer to the Mersey Docks and Harbour Board, and Mr. *E. Eaton*, consulting engineer, all expressed the opinion that the channel for shipping in the Ribble estuary was largely kept clear by the scouring effect of the waters of the Hodder, particularly in flood times. It was the flood waters which would be mainly taken by the Fylde Water Board, and danger was anticipated through variations in the bed of the estuary if the volume of this water was diminished. There was very little tidal volume at the dock entrance. Nearly £1,500,000 had been spent by the Preston Corporation on the dock and harbour entrance; and this must be safeguarded.

At the conclusion of the evidence, there being no other preamble opposition,

The CHAIRMAN indicated to Counsel for the Bill that the Committee did not wish to hear them in reply to the opposition.

Without clearing the room, therefore, the preamble of the Bill was declared proved, subject to the adjustment of clauses.

MISCELLANEOUS NEWS.

EXAMINATION IN "GAS ENGINEERING."

The City and Guilds of London Question Paper.

The first of the examinations in subjects connected with the gas industry held annually under the auspices of the City and Guilds of London Institute took place last week, when candidates were required to answer the following questions in "Gas Engineering" set by Mr. Thomas Glover, of Norwich, the Examiner. The candidates were directed to confine themselves to one grade only, and not to attempt to answer more than eight questions in the four hours allowed. The maximum number of marks obtainable is appended to each question.

HONOURS GRADE.

1. How would you test a sample of coal for the following: Moisture, volatile products, coke, ash, sulphur, and calorific value? Give the approximate figures for any well-known coal with which you are acquainted. [30.]

2. Describe, by means of sketches, a coal-elevator, showing in detail how the power derived from an engine is applied for driving the chain of buckets, and how a regulated feed may be obtained. [40.]

3. What circumstances would regulate the thickness of concrete to be used as a foundation on which to erect a retort-bench? Of what materials and in what proportion would you have the concrete made, and how could the thickness be reduced while retaining the strength required? [45.]

4. Draw the details of bracing required for a bench of retorts built to contain ten horizontal settings, showing also in detail the method of supporting the mouthpieces in one setting. [35.]

5. Discuss the composition and qualities of refractory material best suited for the construction of (*a*) moulded retorts, (*b*) special blocks for combustion chambers, and (*c*) radius blocks for water-gas generator linings. What are the disadvantages of undue expansion in a setting, and how can this defect be avoided? [40.]

6. Describe the Féry Pyrometer and how it is used for ascertaining the temperature of a combustion chamber. What is a fair working temperature of a combustion chamber and of a retort six feet from the mouthpiece immediately the coke from a charge of ordinary duration is withdrawn? [40.]

7. Describe the Burkheiser process of purification. How can the salt of ammonia recovered from the gas be converted into sulphate? [45.]

or, Describe the coal-liming process as applied at Cheltenham, and discuss the results obtained. [45.]

8. How can tar-fog be effectually removed from the crude gas? Why is it advisable to remove tar-fog by special apparatus, and in what position relative to the other apparatus would you fix the extractor? Give your reasons for the position chosen. [30.]

9. Draw a section and plan of a concrete tank wall showing in detail the method of securing the latticed standards for the guide-framing of a gasholder with 30 feet lifts. [35.]

10. Sketch in plan and elevation an arrangement of sulphate of ammonia plant, showing clearly the liquor and gas connections and the course which each follows in passing through the apparatus. [30.]

ORDINARY GRADE.

1. Draw longitudinal and cross sections of a Ω-shaped retort 22 inches by 16 inches by 21 feet long. Show clearly the provision for attaching the mouthpieces and the thickness of the material. [35.]

2. Draw two designs of "bridge" pipes for connecting the ascension pipes to the dip-pipes in the hydraulic main. Point out any particular merit in either design. [35.]

3. In what important particulars does a fire-brick differ from an ordinary red building brick? In what part of a retort-bench could each be safely used, and in what quality of plastic material would the bricks be set? [40.]

4. What weight of dry coke would be made by carbonizing 100 tons of a good bituminous gas coal, and what weight of coke would be used in regenerative furnaces for carbonizing this weight of coal? [35.]

5. Assuming that the tar has been removed from the crude gas, how would two tower scrubbers be employed to best advantage for the complete removal of ammonia? [40.]

6. Sketch a longitudinal section of a 12-inch rack-and-pinion valve with flange and spigot ends. [45.]

7. What apparatus and what method would you employ for adding a measured quantity of air to unpurified gas for the purpose of revivifying the purifying material *in situ*? What circumstances regulate the useful limit of the percentage to be added? [40.]

8. Describe the apparatus used and the method of testing for percentage of CO_2 contained in water gas. What percentage would you expect to find? [35.]

9 What is the difference between a flat-flame and an argand flame and between a luminous flame and a bunsen burner flame? [35.]

10. Describe a "Twaddel's" hydrometer and its use in a gas-works. Give the usual strengths of liquor obtained from the hydraulic main and from the liquor-well. [30.]

The examination in "Gas Supply" will be held next Saturday, when the candidates will be required to deal with the questions to be set by Mr. Walter Hole, of Leeds, the Examiner.

An Acknowledgment at Bradford.—The Bradford Corporation Gas Committee, at their last meeting, passed the following resolution: "That this Committee desire to place on record their appreciation of the special services rendered to the Corporation by the Gas Engineer, Mr. Charles Wood, in anticipation of, and in connection with, the recent coal strike; and also of the manner in which the sale of coke was conducted during the period of the strike."

NEW YORK GAS SUPPLY.

Statistics for the Year 1910.

According to some figures recently published in "Progressive Age," the average quality of the gas supplied in New York in the year 1910 was 22·74 candles, compared with 22·91 candles in 1909, 23·1 candles in 1908, 23·29 candles in 1907, and 23·65 candles in 1906. There was little violation of the requirements in the city proper. Specific gravity tests ranged from ·56 to ·708; averaging about ·64. Pressures taken at various points ran from 2·04 to 5·58 inches as a maximum, and from 1·51 to 3·21 as a minimum; making an average of probably 3·8 inches maximum and 2·2 inches minimum. The sulphur per 100 cubic feet ran from 3·76 to 19·97 grains, or an average of about 6·2 grains. The city had on its streets 17,114 electric arc lamps, 12,449 incandescent lamps, 44,498 gas-lamps, and 1803 naphtha-lamps—a total of 75,864 lamps to a population of 4,982,158, and a total illuminating power of 13,880,169 candles. The failures of light reported were 54,281 for electric arc lamps, 64,945 for incandescent lamps, 38,169 for gas-lamps, and 2851 for naphtha-lamps. Thus the electric arcs had an average of 3·2 failures per lamp, the incandescents 5·2, gas 0·85, and naphtha 1·6. These figures show that gas is by far the most reliable illuminant for street lighting. There is one street-lamp to every 65 persons, giving an average of 185 candles per lamp, or 2·8 candles per head. There were 3596 miles of gas-mains in use in 1910. Some 367 miles of streets were lighted by electric arc lamps, 47 miles by electric incandescents, 375 miles by gas-lamps, and 27 miles by naphtha lamps—a total of 816 miles. There were only 49 open-flame gas-lamps, compared with 44,513 mantle-lamps and 12 open-flame naphtha-lamps, used during the year for street lighting. This was a little more than a year ago; and our contemporary says it shows that gas for street lighting is holding its own, statements to the contrary notwithstanding.

CITY OF SANTOS GAS SUPPLY.

Presiding at the thirty-first annual general meeting, last Tuesday, of the City of Santos Improvements Company, Limited, Mr. D. M. Fox stated that the future expansion of the city was absolutely secured; and he could see no reason whatever why the Company should not participate in the advancing prosperity of the State of San Paulo and its seaport. He proceeded to deal separately with the Company's several undertakings; and in referring to the gas-works, he remarked that the amount delivered for consumption—95,997,800 cubic feet—showed an increase of 7·6 per cent. Public lighting showed an increase of 3¼ per cent., private lighting an increase of 6·5 per cent., and stoves and motors an increase of 10·7 per cent. over the previous year. The make per ton carbonized was over 12,000 cubic feet. In every department there was an increase of consumption—especially in the use of gas for cooking-stoves—and it was expected that, with the recent reduction of price, the public might be induced to use more gas for this purpose, as well as for lighting. Residuals realized 59 per cent. of the cost of coal carbonized. The cost of coal had increased during the year by about 11 per cent. The effect of the reduction of 10 per cent. for public and private lighting as from Jan. 15, 1911, combined with an increase in expenditure, owing to higher price of coal and other causes, had been to considerably reduce the profits. The lighting of the city had given satisfaction to the authorities and the public; but the Board were contemplating further improvements in respect of modernization of the public illumination. In view, he said, of the development of the gas and water supply, the Directors had appointed Mr. A. F. Phillips to be Consulting Engineer for these branches of the business. The report was adopted, and a final dividend for 1911 of 4 per cent., free of income-tax, upon the ordinary capital (making 7 per cent. for the year) was declared.

MELBOURNE GAS COMPANY'S ACCOUNTS.

The following reference to the practice of the Metropolitan of Melbourne Gas Company in establishing reserves appeared in the "Financial Times" last Thursday.

In September last, the matter of the Metropolitan Gas Company of Melbourne was set before readers of these columns. At that time, the enormous price paid for gas by Melbourne consumers—5s. per 1000 cubic feet, and 5s. 7d. when used by poor people in penny-in-the-slot meters—had aroused agitation against the Company, which was given a monopoly by Act of Parliament in 1877—the Charter regulating the dividends payable on a sliding-scale proportionate to the gas charges, with the idea that substantial reductions in the latter would be gained as the profits of the Company increased. But this object, so it was alleged, was defeated by the policy adopted by the Metropolitan Gas Company's Board, of stowing away their superabundant profits in reserve funds, and simply maintaining the level both of the dividends and the charges. "The Act," argued the "Melbourne Age," "specifically limits the creation of reserves to a sum equal to 3 per cent. on the paid-up capital. Yet, in spite of this limitation, the funds set aside out of profits equal 13¾ per cent." It is now apparent, from a recent issue of the "Age" to hand by mail, that the independent Accountants called in to judge the matter—Messrs. C. H. Davis, F.I.A.V., Examiner for the Institute of Accountants and the University of Melbourne in Exchange and Finance, and E. A. Pyke, F.I.A.V.—have reported as to the practice of the Company in establishing reserves as follows:—

"We think the Gas Company misinterprets section 133 of its Act. The intention of Parliament, we think, was that the reserve fund should be used temporarily only for such a purpose as acquiring land, &c. The result of charging the reserve fund, and thereby lessening such account of expenditure to acquire fixed assets, results in the disappearance from the books of such assets, and defeats the intention of section 138, which says such balance-sheet shall contain a summary of the assets and property, capital, and liabilities of the Company, arranged under suitable heads. We consider that the proper course under the Act would be as follows: The reserve fund should be used and absorbed by what may be understood by the term used in the English Act and the present Act, under the designation of contingencies. We think it is the intention, obviously, to preserve a record of fixed assets acquired by charging them to the debit of capital expenditure account. This is intended to be a progressive total, showing every item of expenditure on capital account from the inception of the Company to date. We think that the reserve fund, if used under the authority presumably conferred by this section for acquiring land, machinery, &c., is only intended to be used for that purpose temporarily. Directly an asset is acquired and charged to an asset or investment account, it should be transferred thence to capital expenditure account. The result of this course of treatment would be that the statutory reserve fund would only be depleted by contingencies incidental to the business and equalization of dividends, and capital account would show the gross total expended in acquiring assets. But the practice of the Gas Company has been to deplete the reserve fund also by the purchase of assets. We think that the reserve fund should be adjusted and restored by reversing all incorrect entries—namely, by debiting capital expenditure for fixed assets acquired and crediting the reserve fund. We have shown that, in our opinion, the Gas Company has not conformed to the Statute, and, therefore, in this respect has acted illegally. It will be obvious that if our suggestions were adopted capital expenditure account would be overdrawn to an amount which we state in round numbers at over £500,000 in excess of the present overdrawn amount of £1991 12s. 3d. By the journal entry making this adjustment, it follows there would be a credit for exactly the same amount as capital is debited with, passed to the credit of the statutory reserve fund. As the statutory reserve fund limit is £214,000 in round figures, it is apparent that the statutory reserve fund limit has been illegally exceeded."

This opinion throws a flood of light on the Board's mistaken methods, and will, no doubt, lead to a more satisfactory condition of affairs both for shareholders and consumers. In this connection may be quoted a further statement of the report, to the effect that, "another ill-effect of the present system of not debiting capital is that it has had the effect, through charging to revenue of capital items, of lessening the amount available half yearly for distribution in dividends; the object, presumably, being to keep shareholders from crying out for increased dividends, which would, if granted, have the effect of lowering the price of gas."

ROCHDALE GAS UNDERTAKING.

The annual statement of accounts presented to the Gas Committee of the Rochdale Corporation at last Wednesday's meeting showed that there was a net profit of £20,306 on the year's working, which is the largest in the history of the undertaking. It is £2398 in excess of last year, £6642 more than was the case for 1909-10, and £8629 in advance of the profit recorded for 1908-9. The nearest approach to it was that of £19,598 seven years ago, and £17,692 in the following year. The total income for the twelve months ended March last was over £97,000, or about £3000 in excess of the receipts for the previous year. The revenue from gas was £60,725; this being an advance on last year of £73 only. Residual products, however, yielded £29,415, or £4122 more; and the increased income from sales of coke was £3300. In the case of street lighting, for which purpose gas is supplied at cost price, the income was £6885, or £845 less than last year. The working expenses of the department totalled £65,711, an increase of £2365. Stokers' wages (which amounted to £5310) show a reduction of £1065, chiefly due to the introduction of mechanical stokers in connection with the new vertical retorts. With working expenses deducted, the gross profit was £31,813, compared with £29,847 for 1910-11, an increase of £1966. From this had to be deducted £11,500 for interest and sinking fund charges, &c., leaving a net balance of £20,306. The accounts also showed that, towards the £25,500 which the new retort-house, the installation of vertical retorts, and the high-level road cost, £23,435 had been paid, including £5362 from the reserve fund during the past year. The capital expenditure on the works totals nearly £260,000; the amount to the credit of sinking fund is £61,392.

At their meeting on Wednesday, the Committee decided to pay out of the past year's profit the balance of £2500 owing on the new works, and to apply a further £1400 to reserve, in view of other work which needs to be done. From the balance, they propose to hand over £15,000 in relief of rates, which is £3000 more than was given last year. This decision was not arrived at, however, without considerable discussion. There was a proposal that the whole of the net profit, after the payment of the £2500 due on the recent extensions, be given to the rates; but this was rejected by a substantial majority. A further suggestion put forward was that only £12,000 be handed over (the same as last year), and attention directed to the cheapening of gas to all grades of consumers. This proposal was also rejected.

It is of interest to note that, in the last eighteen years, over £200,000 has been contributed to the relief of the rates out of gas profits at Rochdale, and that in the last seven years the total amount given for the same purpose out of profits on the Electricity Department has been £22,350. During the past year, the electricity works profit was only £2610; being £2799 less than in the previous twelve months—and, in fact, about the lowest recorded by the department since its inauguration. Consequently, the Committee proposed that £2000 should go in relief of rates this time, or £3000 less than last year.

The Town Council, meeting in General Purposes Committee on Friday, dealt with the estimates. A long discussion resulted upon a proposal by the Finance Committee to take an additional £1500 from the gas and electricity profits, making £18,000 in all. The Chairman of the Gas and Electricity Committee (Mr. Walker) vigorously opposed the proposition, as did other members of the Council; it being urged that it was important for the departments to have a reserve. On a vote being taken, however, the proposal of the Finance Committee was approved of by 18 to 10. The net result of the Finance Committee's efforts is that a prospective increase in the rates by 6d. in the pound has been brought down to a penny; the total rate being 8s., compared with 7s. 11d. last year.

NELSON CORPORATION GAS UNDERTAKING.

In the course of his second annual report to the Chairman and members of the Nelson Corporation Gas Committee, the Gas Engineer and Manager (Mr. A. Morton Fyffe) says that the expenditure on revenue account during the year to March 31 was £49,675, and the income £59,687. The result is a gross profit of £22,451, and a net profit of £10,012. The net profit for the previous year was £7666. The net profit per 1000 cubic feet of gas sent out is 6·39d., as compared with 5·24d. for the preceding year, and 3·17d. for the year before that. Over this period the price charged has been 2s. 3d. per 1000 cubic feet. The total quantity of gas made in the past twelve months was 375,874,000 cubic feet; the proportions being 95·28 per cent. of coal gas and 4·72 per cent. of carburetted water gas. The make of gas per ton of coal worked out at 11,722 cubic feet, against 11,285 cubic feet in the previous year. The cost of coal delivered at the works was 11s. 5¾d. per ton; and the net income from residuals (after deducting all expenses of manufacture and handling) gave a return of 7s. 9¾d. per ton of coal—making the net cost of coal 3s. 8d. per ton delivered at the works, as compared with 4s. 0¾d. for 1910-11. The total quantity of gas delivered during the year was 375,795,000 cubic feet; being an increase of 25,061,000 feet, or 7·14 per cent., on the quantity delivered in the preceding twelve months, which in its turn showed an increase of 6·73 per cent. over the year preceding. Of the total consumption last year, 33·32 per cent. was taken by prepayment meter users. The average illuminating power of the gas was 17·28 candles; and the average calorific value, 535 B.Th.U. The unusually warm weather during last summer raised the gas consumption for cooking purposes; while the stoppage of the cotton mills during January caused a loss of consumption in that month. There are now 13,684 consumers on the books—6234 ordinary, and 7450 prepayment—being a total increase of 627 consumers in the twelve months. So far as can be ascertained, there are at present in use 6800 gas-cookers, 5300 gas wash-boilers, 4121 grillers, and 600 fires, &c.—a total of 16,821 gas appliances in the area of supply. During the year it was decided to instal new carbonizing plant at the Nelson works; and after minute investigation and consideration, it was decided to adopt vertical retorts on the Glover-West continuous system. This plant, which is now in course of erection, will, when completed, be capable of carbonizing 110 tons per 24 hours, and will increase the combined output of the Nelson and Brierfield works by 24 per cent. It is expected that the capital charges on the estimated cost of £21,650 will be fully met by the saving obtainable in working.

In the concluding portion of his report, Mr. Fyffe says: "The year under review has been one of unprecedented prosperity, both from the point of view of expansion of business and financial results. The former is due partly to the growth of the town and partly to the increased number of gas cookers and boilers in use. The financial result obtained is due to various causes, including economies in working, improvements in manufacture, favourable markets for residuals, &c. The question of efficient distribution has received very careful attention during the year; and the sum of £601 has been expended on repairs and renewals to mains and services, as compared with £278 during the previous year. For the coming year, a sum of £1100 is allowed for in the estimates for this work. It has also been decided to undertake to give consumers the full benefit of the uses of gas by adjusting and putting right all gas fittings and appliances free of charge; and it is felt that such a step will be of very great advantage to the ratepayers. The question of the price of gas was left over until the new carbonizing plant in course of erection at the Nelson works has been completed; but the rate for power purposes has been altered to a sliding-scale according to the quantity used. This it is expected will increase the daylight consumption. Having regard to the fact that the profit per 1000 cubic feet of gas has risen from 3·17d. to 6·39d. in two years, the question of a general reduction in price must be faced in the future."

ELECTRIC LIGHT UNDERTAKINGS IN SMALL TOWNS.

The Financial Aspect of the Question.

Some time ago, a deputation from the Aylesbury Urban District Council visited Chichester for the purpose of inspecting the works and plant of the Electric Light and Power Company, and obtaining from the Engineer (Mr. R. V. Weare) some particulars to assist them in connection with a proposal to introduce electric lighting in their town. The event subsequently gave rise to some correspondence in the "Bucks Herald," in which the above-named gentleman and Mr. T. E. Pye, the Engineer and Manager of the Chichester Gas Company, have been taking a conspicuous part. Mr. Pye submitted that electricity undertakings in small residential towns usually become a burden upon the ratepayers. Mr. Weare replied to this by quoting the following figures from a summary of the returns from electric lighting undertakings in the United Kingdom for the year 1910-11:

Number of undertakings	311
Total capital expenditure	£60,552,721
Total revenue	7,714,637
Total expenses	3,596,693
Gross profit	4,117,944
Depreciation and loan repayments	1,493,332
Net profit per £100 of capital	4·33 per cent.

His object in giving these figures was to disprove a statement made by Mr. Pye that the electric lighting profession was a very "harassed" one, and to show that Aylesbury was being asked to partake in what had been proved to be a "sound investment."

In the course of a long letter in reply, Mr. Pye pointed out that from the totals submitted by Mr. Weare the figures showing the gross profit and the amount set aside for depreciation and sinking fund per £100 of capital—£6·8 and £2·47 respectively—had been omitted; and he con-

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sequently asked why this had been done. He answered his own question by saying it was because the percentage of depreciation, *plus* the repayment of loans, shown by the returns was less than 2½ per cent. per annum, or equal to a forty years' purchase. He added that Mr. Weare must have known perfectly well that none but those engaged in a very seriously "harassed" profession would dare to make up accounts and declare surplus profits while the necessary provision for imperative renewals in the early future was being scandalously neglected. Mr. Pye further pointed out that the gross profit recorded in the official returns for the whole of the electricity supply industry (other than tramways) for the United Kingdom amounts to 6·8 per cent. on the capital employed, which, after allowing the depreciation of 6 per cent. which, according to the "Mechanical World Electrical Pocket-Book," is necessary, leaves the net profit of only 16s. per £100 of capital, without allowing one penny for repayment of loans.

Mr. Pye went on to show that as the figures quoted by Mr. Weare relate to all the electric lighting undertakings of the country owned by companies and local authorities, large and small, they are wholly deceptive and misleading as applied to Aylesbury. The only possible guide which such returns could afford must, of course, be those of a local authority's works of about the size and capacity of those proposed for Aylesbury. The returns from which Mr. Weare quoted include those of sixteen such undertakings, serving areas of which the populations are 13,000 and less; and of these, six show a surplus aggregating £2903, or 1·3 per cent. on the £219,523 of capital employed. The loan repayments were £7549, or 3·4 per cent., or close on a thirty years' purchase of the plant, much of which could not live for fifteen years. Mr. Pye remarked that had the conductors of these undertakings written off 6 per cent. of their capital as depreciation, in addition to making the necessary loan repayments, their returns would have shown a deficit of £10,268, instead of a surplus. Of the remaining ten undertakings comparable with Aylesbury, the results all show deficits, amounting to £5367; the capital invested being £268,738, and the loan repayments amounting to £8784, or some 3·3 per cent., or thirty years' purchase. Had the owners of these undertakings also taken the safe line, and written off 6 per cent. of the capital in respect of their short-lived plant, in addition to making the loan repayments, their deficit would have amounted to £21,493.

This, said Mr. Pye, is the tale, brought up to date, of small-town local authority electricity supply enterprise, as published by an official organ of the industry. Sixteen undertakings—the only ones reported upon of the size at all comparable with Aylesbury—show by their own balance-sheets an aggregate deficit of £2464; and if these balance-sheets had provided in addition for less than half of the depreciation allowance called for by the electrical authority already quoted—bringing the total depreciation *plus* the loan repayments up to 6 per cent.—the aggregate deficits reported, which must, sooner or later, be made up by the ratepayers, would amount to £15,426; and this in respect of a capital outlay, on the credit of the local rates, of £488,261, or a loss to the ratepayers of more than £3 every year for every £100 invested.

GAS-FURNACES FOR INDUSTRIAL USE.

Lecture and Demonstration at Edinburgh.

With a view to the further introduction of gas for industrial purposes, a lecture was delivered by Mr. E. P. TAUDEVIN (of the Richmond Gas Stove and Meter Company) in the Livingstone Hall, Edinburgh, last Thursday evening. The address was under the auspices of the Edinburgh and Leith Corporations Gas Commissioners, and was in continuance of the forward policy which had been so successfully carried out of late. There was a large attendance, representative of the various industrial interests of the city and district. The chair was occupied by Bailie LINDSAY, the Convener of the Finance and Law Committee.

Bailie LINDSAY, in opening the proceedings, said he was very pleased to see such a large attendance. He thought their presence was indicative of their desire to keep themselves, and consequently the various industries that they represented, abreast of the times so far as gas appliances were concerned. Needless to say, the Gas Commissioners, from no philanthropic motive, were particularly anxious to get them to use gas in the various industrial purposes to which it could be put; and with this end in view, the Commissioners had invited Mr. Taudevin to give them the benefit of the latest knowledge in the application of the various gas appliances to industrial purposes. The application of gas for industrial use was now becoming very general; and he thought it was more likely to increase rather than otherwise. During recent years, great attention had been devoted to the construction of appliances which would give high efficiency, low working costs, and thermal heat. He hoped that the ultimate end of the meeting would be of advantage to all concerned.

Mr. TAUDEVIN then delivered his address, which was substantially the same as that given in Glasgow on March 13, and which appeared in the "JOURNAL" for March 19 (p. 809). The lecturer made special references to the adaptability of the gas-fired furnaces to Edinburgh's staple industry—viz., that of lead melting in the printing trade—and remarked that for local requirements in this direction a special type of furnace would be made. The utility of small furnaces for various local purposes, such as brass work and the making of small machine parts, was also emphasized.

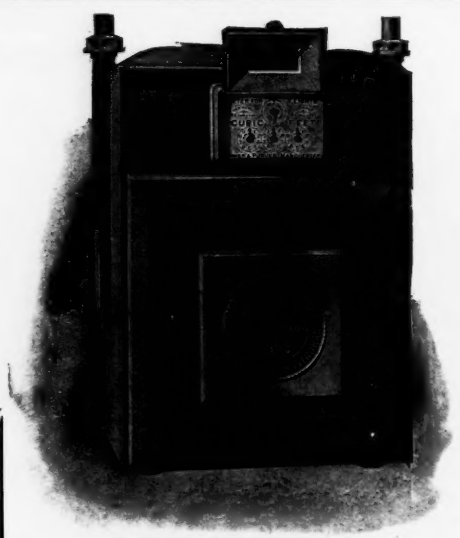
At the conclusion of the lecture, Mr. Taudevin explained the operation of a natural-draught furnace, which was fitted up in the hall. A number of questions were put to the lecturer in elucidation of the operation of the furnaces.

Bailie LINDSAY expressed the pleasure he felt at being present at the lecture, which had been practical to the last degree; and those of them who were more practical than he was would have enjoyed it all the more. He concluded by moving a vote of thanks to the lecturer.

Mr. TAUDEVIN, in acknowledging, returned thanks for the kindness and attention with which he had been received.

Mr. A. MASTERTON (Gas Engineer and Manager) proposed a vote

DRY GAS METERS.



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of thanks to Bailie Lindsay for presiding, and remarked upon the great interest he had taken in furthering the consumption of gas locally. He also mentioned that it was due to Bailie Lindsay that the demonstration and lecture had been given that evening.

The interest in the lecture was materially enhanced by the fine series of slides which were shown on the screen during the lecture and at its conclusion, which afforded Mr. Taudevin the opportunity of referring more in detail to the particular features of the different furnaces, and illustrating local and other uses to which they could be put.

STOKE COUNCIL AND THE POTTERIES WATER BILL.

At last Thursday's meeting of the Stoke-on-Trent (Potteries) Federated Council, there was a surprising development of the water question. At the previous meeting of the Council, it had been decided to withdraw opposition to the Bill of the Staffordshire Potteries Water Company on certain concessions as to the price of water in the federated area being granted by the Company. On Thursday, however, notice of motion was on the *agenda* in the name of Mr. H. Leese, to call attention to the statement made by the Chairman of the Ways and Means Committee in the House of Commons on the second reading of the Bill, and to move a resolution thereon.

The resolution he moved was in the following terms: "That we thank Mr. John Ward, M.P., for his action in blocking the Staffordshire Potteries Water Bill; and in view of the fact that a number of the members of the Council were under a misapprehension when the Bill was taken at the previous Council meeting, we request Mr. Ward further to block the Bill, with a view to delaying its passing into law this session, so as to give the Council an opportunity of reconsidering their position with regard to the Bill." Mr. Leese said his reason for taking the present course was that all the facts had not been placed before the Council when the previous decision was arrived at. The Council had been misled. The Chairman of the Ways and Means Committee in the House had stated that a purchase clause could have been inserted in the Bill had the Corporation asked for it.

The hope was expressed by the Deputy-Mayor that the resolution would not be carried. He urged that, while no doubt perfectly legal, it would amount morally to a breach of an honourable understanding with the Water Company. The Chairman of the Water Committee (Mr. Brookhouse) remarked that a clause inserted in the agreement between the Corporation and the Company, that all the concessions granted by the Company should become null and void unless the Bill became law within six months, had never been before the Water Committee or the Council. He alleged that every means, both fair and unfair, had been tried by the Company to bring the Council to their feet. He accused members of the Council of unfair tactics in regard to the Bill.

The motion was carried by 45 votes to 18.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

An elaborate report as to the effect of the National Insurance Act, 1911, upon the Edinburgh and Leith Corporations' gas employees has been issued, which shows that the claim to a certificate of exemption as to their employees coming under the Act has been made out. The number of insurable workmen in the Engineer's department, on the average of three years to Dec. 31 last, was 718. The contributions under the Act, at 4d. per week, would amount to £622 3s. 4d.; the Commissioners' contributions, at 3d. per week, to £466 14s.; and the Treasury's contribution, to (say) £311 2s. 8d.—altogether a total of £1400 2s. per annum. To secure a certificate of exemption, it is pointed out that the Commissioners will have to pay the sickness and disablement benefits for which they are liable; and this is put, on a liberal estimate, at £100 per annum, which would save the Commissioners £360 per annum, relieve the employees of contributing weekly, and the Treasury from making their grant. The workmen's sick benefit society could be continued or wound up. The employees under the Engineer, other than manual labourers, number 112 men; and last year they drew sick pay amounting to £46 10s. 2d. The workmen under the Act would have to pay £97 1s. 4d., the Commissioners in respect thereof £72 16s., and the Treasury £48 10s. 8d.—a total of £218 8s. In the Treasurer's Department, the total contributions would amount to £136 13s. 6d.; whereas last year those absent through sickness drew only £25 2s. 7d. It is pointed out that unemployment insurance may apply to one or two of the employees.

The concluding series of cookery demonstrations and gas exhibitions given under the auspices of the Edinburgh and Leith Corporations' Gas Commissioners was held in the Livingstone Hall, Edinburgh, on Wednesday, Thursday, and Friday. The exhibition was opened on Wednesday by Bailie Laing, in the presence of a large number of ladies and gentlemen. He recalled that when, some thirty years ago, gas-cookers came to be more generally introduced, there was a great deal of prejudice against them; but he was glad to say this had now practically all disappeared. Cooking by gas had many advantages; and he was sure the public of Edinburgh and Leith would respond to the facilities which the Gas Commissioners were introducing in regard to a wider use of the cookers. No rent would be charged for the cookers, which would be on loan entirely free of charge, and fitted-up free. Mr. Alexander Masterton, the Engineer and Manager to the Commissioners, after moving a vote of thanks to Bailie Laing, gave a description of the collection of various appliances for lighting, heating, and cooking, which were on view in the hall. The series of cookery demonstrations given by Miss Dods was most successful.

The Gas Committee of the Greenock Corporation have agreed to recommend that the work of installing a new high-pressure main at a cost of £10,000 be proceeded with.

An application from the firemen and the barrowmen of the Aberdeen

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Corporation Gas-Works for an increase of wages came before the meeting of the Gas Committee last Wednesday. The Committee, after considering the matter, remitted it to be considered by the Gas Engineer, Mr. Samuel Milne.

In connection with the Dundee Gas-Works, a class has been formed for the benefit of fitters in the employ of the Gas Department. Mr. Alex. Yuill, the Gas Engineer, has been ably supported by his assistants in carrying out the scheme, which embraces technical as well as practical work. At the inauguration of the class, Mr. Yuill pointed out the benefits that would accrue through the interchange of ideas. Many difficulties which they met with in the course of their work could be dealt with. He referred to the necessity for cultivating a courteous manner when meeting the consumers. Mr. James Mitchell, the Assistant Engineer, delivered a very interesting and instructive lecture on "Wet and Dry Meters."

The Cowal District Committee met on Wednesday, when a scheme for lighting the public roads by gas was approved. The gas will be supplied from Dunoon; and application is to be made to the County Council for power to borrow sufficient for the outlay contemplated.

At a meeting of the Cleaning and Lighting Committee of the Edinburgh Town Council on Tuesday, there were submitted the provisional estimates for the year from May 15, 1912, to May 15, 1913. For lighting by gas, the estimated expenditure was £45,145, against an estimate of £45,360 last year, and an actual expenditure in 1910-11 of £44,608. The estimated revenue was £200.

A special meeting of the Peterhead Town Council was held on Thursday evening. After the election of Mr. A. Davidson as Town Chamberlain and Gas Treasurer, Mr. Gordon stated that, no matter who had been appointed, he reserved his right to move later for a full and independent investigation into the gas matters.

At Perth Police Court, a woman was sent to prison for twenty days for stealing 16,000 cubic feet of gas. A charge of stealing the money from a penny-in-the-slot meter was denied.

As indicating the drought that has been experienced in the Edinburgh district of late, the returns of the Edinburgh and District Water Trust on Tuesday showed a diminution in the available water supply during the fortnight of 67,810,000 gallons.

A serious state of matters has been foreshadowed in regard to the water supply of a large area in Fifeshire. When the Glenguey water-works were completed, at a cost of £250,000, it was estimated that ample provision had been made for the three partners in the concern—viz., the Dunfermline District Committee, the Inverkeithing Town Council, and the Admiralty. The calculations that were made have been found to be inadequate, and practically the whole of the water supply is being utilized already. The Admiralty had indicated that within a few years a supply of water will be asked for in excess of the capabilities of Glenguey; and how the situation is to be met is now receiving serious attention. Meantime, a policy of retrenchment has been entered upon; intimation having been made to the Cowdenbeath and Lochgelly local authorities that the Glenguey supplies to these towns cannot now be guaranteed.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April 27.*

Sulphate of Ammonia.

The approach of the end of the month has brought about less keenness in the demand, but supplies have still been by no means abundant, and the market generally has not given way to any great extent during the past week. Owing to the scarcity of suitable freight opportunities from Leith, this point of delivery has, contrary to what is usually the case, been the cheapest port, but no doubt this anomaly is only temporary. The nearest values at the close are £14 18s. 9d. per ton f.o.b. Hull, £15 per ton f.o.b. Liverpool, and £14 17s. 6d. per ton f.o.b. Leith. For future delivery, the tone is also quieter; but it is reported that transactions have again taken place for shipment late this year and early next year at the parity of £14 10s. per ton f.o.b. Liverpool.

Nitrate of Soda.

The market for this material continues very steady, and the quotations are well maintained at 11s. 1½d. per cwt. for ordinary, and 11s. 3d. for refined quality, on spot.

LONDON, *April 29.*

Tar Products.

The markets for tar products continue firm. In pitch, there has been a further improvement during the week; and the inquiry has been exceedingly good for both prompt and forward delivery. Benzols are firm; but there is little business doing. Solvent and heavy naphthas are in good demand. In creosote, there is a fair amount of business, and prices are very high. There is little business doing in crude carbolic acid for either prompt or forward delivery, and consumers are not willing to purchase except at reduced prices.

The average values during the week were: Tar, 27s. 9d. to 31s. 9d. *ex* works. Pitch, London, 52s. 6d. to 54s.; east coast, 52s. to 53s. 6d.; west coast, Clyde 53s. to 53s. 6d., Manchester 50s. 6d. to 52s. 6d, Liverpool, 52s. 6d. to 53s. 6d. Benzol, 90 per cent., naked, London, 11d. to 11½d.; North, 10¾d. to 11d.; 50-90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10d. to 10½d.; North, 9½d. to 10d. Crude naphtha, in bulk, London, 4½d. to 5d.; North, 3⅜d. to 4½d. Solvent naphtha, naked, London, 1s. 0½d. to 1s. 1d. f.o.b.; North, 10¾d. to 11d. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅞d. to 3⅛d.; North, 2⅝d. to 2¾d. Heavy oils, in bulk, 3¼d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 5d. to 2s. 6d. Naphthalene, £4 10s. to £8 10s.; salts, 45s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This market has been decidedly dull during the past week, and efforts which have been made to make sales for May have not been

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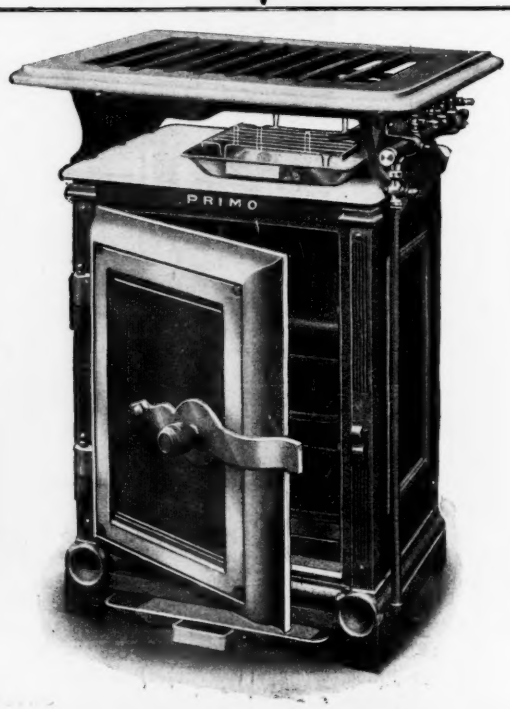

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successful. Actual Beckton is still quoted £14 5s. Outside London makes are £14; Hull, £14 17s. 6d. to £14 18s. 9d.; Leith, £15; Liverpool, £14 18s. 9d. to £15; Middlesbrough, £14 18s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is now something that is near a normal production of coal; but it is fully taken up by a keen demand, which keeps up the prices. In the steam coal trade, best Northumbrian steams are from 16s. 6d. to 17s. per ton f.o.b.; second-class steams are about 15s. 6d. to 16s.; and steam smalls are firm. The opening of the Baltic trade is near; and this will add to the demand, and may further stiffen the prices of some qualities of coal. In gas coal, there is a strong demand for all qualities, both for home use and for export. Though the collieries are now working more fully, consumers wish to increase their stocks, and the output is rapidly taken up. Best Durham gas coals are now quoted from 16s. 6d. to 17s. per ton f.o.b.; second class coals are from 15s. to 16s.; and for "Wear" specials, from 17s. to 18s. is quoted. These prices for gas coals are higher than just at the beginning of the strike, when its endurance was expected to be limited. In the coke trade, the demand is full. Gas coke is scarce; some of the producers having little for sale. Prices vary considerably for good gas coke—about £1 per ton is a current quotation f.o.b. in the Tyne. It is believed, however, that a few hundred tons of gas coke have been sold at about 22s. 6d. per ton f.o.b.—a high price for export.

Scotch Coal Trade.

Great activity is being experienced throughout the Scotch coal trade; and prices rule at a fairly high level. There is also an expansion in the export market. On Friday, prices were: Steam coal, 15s. to 16s. per ton f.o.b. Glasgow; splint, 15s. 6d. to 16s. 6d.; ell, 15s. 6d. to 16s. 6d.; trebles, 15s. to 15s. 6d.; doubles, 14s. to 14s. 6d.; and singles, 12s. to 12s. 6d. Prices for dross at Methil and at Leith were 8s. to 9s. 6d. f.o.b.

Cheap Gas and Smoke Abatement.—The Lord Mayor of Manchester (Mr. W. T. Royse) has accepted the Presidency of the Manchester and District Branch of the Smoke Abatement League of Great Britain, which was formally founded last week. The Vice-Presidents include Mr. W. Kay (the Chairman of the Gas Committee). At the foundation meeting, Mr. E. D. Simons, in acknowledging the compliment paid him by his election as Chairman of the Branch, said, with regard to domestic smoke, that cheap gas and electricity were undoubtedly the things to go for. The Trading Profits Special Committee of the City Council had consented to receive a deputation to urge the abolition or reduction of the contributions made from the profits of the gas and electricity undertakings in relief of the rates; and a pamphlet on the subject had been prepared and printed.

Sales of Shares.—At an auction sale at Brighton, five lots of three fully-paid £5 shares in the Hurstpierpoint Gas Company, Limited, were disposed of at the rate of £6 15s. per share. At a local sale last Wednesday, £614 of 5 per cent. consolidated stock in the Northampton Gas Company realized £112 10s. per cent.

Warrington Water-Works Extensions.—A Local Government Board inquiry was held at Warrington last Wednesday, by Mr. W. O. E. Meade King, with reference to an application by the Corporation for sanction to borrow £5600 for the provision of new pumping-plant at the Houghton Green Water-Works. It was explained by the Deputy Town Clerk that the reason for the application was that, in the event of a breakdown at this station, the needs of the district could not be fully supplied. Evidence as to the proposed additional plant and the extent of the present undertaking was given by Mr. James Gray, the Water Engineer. The application was opposed by Mr. S. Gough, who contended that either of the two existing stations would meet the demands, and the borrowing of money was unnecessary.

Winsford Gas-Works.—At the annual meeting of the Winsford (Cheshire) Urban District Council last Wednesday, the Gas Manager (Mr. F. Sidwell) reported that the make of gas for the year ended March 31 had been 32,647,700 cubic feet; being an increase over the previous year of 2,061,300 feet. The amount sold to consumers was 29,428,488 cubic feet; representing an increase of 2,641,452 feet, or 9·8 per cent. The engine, plant on works, &c., accounted for 1,147,720 cubic feet; while the quantity unaccounted for (through condensation, subsidence, &c.) was 2,071,492 feet—this being a percentage of 6·77, compared with 8·66 the preceding year. The make per ton of coal carbonized was 11,295 cubic feet, as against 11,311 feet. The credit balance on the gas account at the end of the year was £617. In reply to a question, Mr. Sidwell stated that the amount of coal in stock when the strike commenced was over 400 tons; and he was congratulated upon his foresight.

Financial Results at Huddersfield.—The Chairman of the Financial Committee (Alderman Woodhead), when presenting his "budget" to the Huddersfield Town Council, said the gas-works and tramways had contributed to the relief of the rates amounts equal to 3d. and 3¼d. in the pound respectively. The Gas Committee's minutes showed that the receipts of the department for the past year were £106,759, against £104,504 for the previous year. The expenditure was £98,698, against £95,816. It was recommended that £5983 be transferred to the borough fund, and £2077 put to the depreciation and contingencies account, bringing it up to £38,915. The minutes were adopted. The Water Committee's minutes showed an income of £78,837 (including £11,683, or 6d. in the pound, from the borough rate), against £74,821 for the preceding year. The expenditure was £88,809, against £86,503—leaving a debit balance of £9972, against £11,683. A sum of £762 had been transferred to the depreciation and contingencies fund, which now totals £20,008. The Committee recommended that an amount equal to 5d. in the pound be provided from the next borough rate to meet the deficit. The minutes were confirmed.

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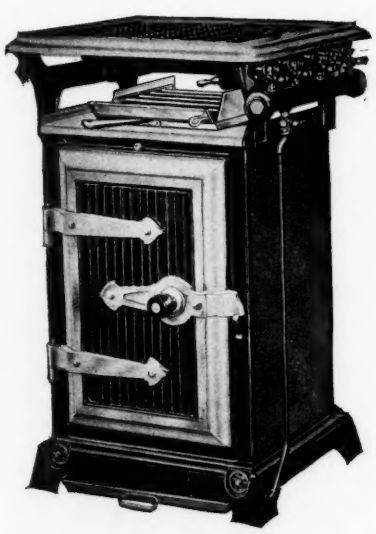

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Liability for Damages through a Gas Explosion.

At the Lambeth County Court last Tuesday, His Honour Judge Parry gave judgment in a case in which a window cleaner named William Larking sought to recover from William Bunnell, the landlord of the "Elephant and Castle" public-house, Old Kent Road, damages in respect of injuries caused through an explosion of gas. The facts of the case were given in the "JOURNAL" for the 19th ult. (p. 814). His Honour said that Counsel for the plaintiff (Mr. Charles Doughty) had put the case in a nutshell by asking him to decide that gas was a "wild beast." Was the owner of a house in which gas was laid on in the same position as a man keeping a savage and ferocious animal, whose liability was well known? A man who owned an article dangerous in itself, such as gas, poison, firearms, or gunpowder, had to take every precaution to prevent accident; but, having done this, he would not be liable because an accident happened. In the present case, there was no evidence of negligence, and therefore there would be judgment for the defendant, with costs.

Manchester Water Supply.

The Water Committee of the Manchester Corporation announce that there will be no increase this year in the water-rate, which will accordingly remain at 3d. for public purposes and 9d. for domestic use. The accounts for the year to March 31 show that the receipts from the supply of water within the city amounted to £274,955, and outside the city to £148,804, giving a total of £423,759. The payments were £504,623; and the balance due to the bankers at the end of the financial year was £68,602, less £160 in the hands of the City Treasurer. In the estimates for the current year, the Committee schedule £180,000 as the further sum to be spent on the third line of pipes from Thirlmere. Last year the amount estimated was £315,000, of which £245,767 was actually spent. It is proposed this year to spend £110,000 on the Heaton Park reservoir, against £37,170 last year. The average daily quantity of water supplied during the last financial year was 40,337,492 gallons, of which 22,159,899 gallons were obtained from Longdendale and 18,177,593 gallons from Thirlmere. There were 336,113,400 gallons of power water pumped into the hydraulic mains during the year—an increase of 47,246,900 gallons. Of this quantity, 161,427,700 gallons were raised from wells at the Whitworth Street West and Water Street Stations; the remainder being obtained from the ordinary water supply.

Hertford Public Lighting.—After severe competition with the North Metropolitan Electric Power Distribution Company, the Hertford Gas Company have obtained the public lighting contract for a further five years; No. 4 Kern burners being the standard stipulated by the Corporation in their case and a 75-candle lamp for the Electric Company.

South Metropolitan Gas Company Publicly Thanked.

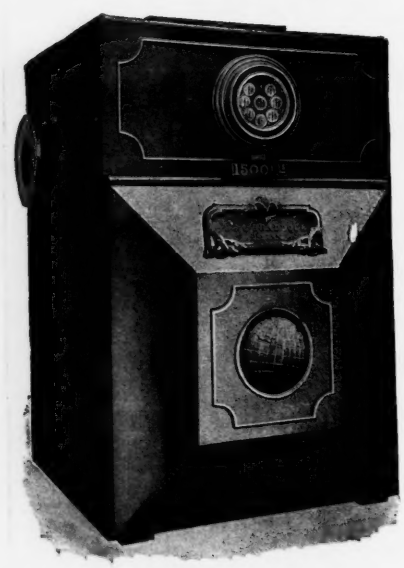
At a meeting of the Camberwell Borough Council last Wednesday, it was resolved to tender to the South Metropolitan Gas Company the thanks of the borough, under the seal of the Council, for their assistance during the recent coal strike, when the Company arranged to keep the public baths and washhouses in the borough fully supplied with coke, which was of great assistance, and for which no additional charge over and above the ordinary price was made. Mr. J. Shrimpton, in making the proposition, said the Company rendered the borough a great service. Not only did they supply the Council with coke, but also some large industrial works, which enabled them to keep all their employees engaged—thus saving great distress among the working population. Mr. C. E. Newton, is seconding, remarked that if all the traders in London had been treated in the same considerate manner, a lot of anxiety, trouble, and misery would have been avoided. By the humane action of the South Metropolitan Gas Company much suffering was removed. The Council unanimously agreed to the proposal.

High-Pressure Gas Installation in Glasgow Streets.

The Glasgow Corporation Gas Department have now completed the high-pressure gas installation in Bath Street, with the exception of a small portion of the thoroughfare, which is expected to be ready for next lighting season. There are 41 lamps in operation at present—17 of 4500-candle power each, and 24 of 3000-candle power each, giving a total light of 148,500 candles, at 80 inches water-column pressure. These lamps have been supplied by different makers; and it may be stated that 18 are Keith, 11 are Graetzin, and 12 are Pharos lamps. These will displace the small existing street-lamps in their immediate vicinity, which only yield approximately a light equal to 10,000 candles. The compressing plant consists of two compressors, having together a capacity of 14,000 cubic feet of gas per hour, at 90 inches water-column pressure; and both compressors are driven by gas-engines. By a simple device, the Graetzin and Pharos lights can be controlled from the compressor-house, so that two of the burners can be extinguished at midnight, leaving one burner lighted in each lamp. Mr. Alex. Wilson the Gas Engineer, and Mr. W. Grafton, his Chief Assistant, are to be congratulated on the satisfactory conclusion of the high-pressure lighting scheme; and it is to be hoped that the brilliant display of light in Bath Street will induce the Corporation to extend this new system of lighting to other portions of the city.

Another Co-Partnership Gas Company.—We are pleased to learn that the Directors of the Hertford Gas Company have inaugurated a co-partnership scheme. The profit divided annually will be based on the selling price of gas; and at the present figure—3s. 5d. per 1000 cubic feet—it will be 5 per cent. on the amount annually paid to each employee as wages. This is among the smallest of the gas companies to adopt co-partnership.

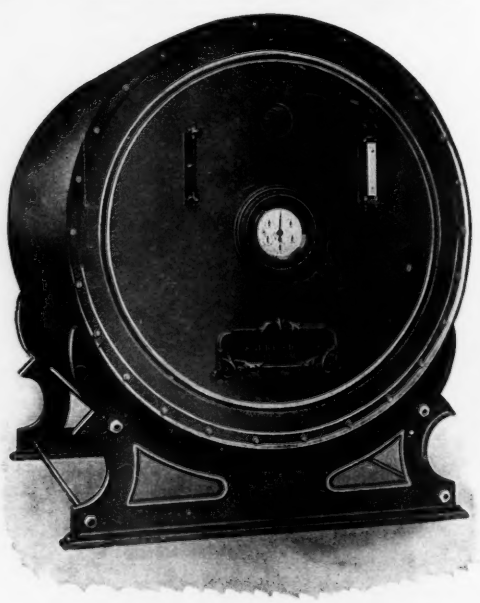
BRADDOCK'S IMPROVED GAS METERS



No. 219. Braddock's Large Dry Meter.

SECOND TO NONE.

Made in all Sizes.



No. 245. Braddock's Large Wet Meter.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

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Smethwick Gas Undertaking.

An interesting statement has just been issued by Alderman Pinkney (the Chairman of the Smethwick Gas Committee), which points out that the coal supplies are again coming in. The Committee, he says, are gratified that they were enabled so successfully to tide over the difficulty of the strike, without any relaxation of the supply of gas in any district. Of course, they took the early precaution to cut down street lighting, as that curtailment would cause no suffering. This, however, is being re-instated, and about 70 per cent. of the street-lamps are now being lighted. The restriction of the coke supply had caused some suffering; but it is pointed out that, even though a residual, there was a time when, in comparison with coal, coke was five times the value to them. One pound of coal is capable of producing 5 cubic feet of gas, while a pound of coke produces 26½ cubic feet. Naturally, the Committee husbanded their coke as much as they could, and converted it into gas. Unscreened breeze they had been able to let manufacturers have; and this, mixed with ordinary fuel, had enabled them to continue their trade during the strike.

Reduction in Price at Wokingham.—The Gas Committee at Wokingham announce a reduction of 5d. per 1000 cubic feet in the price of gas, thus bringing the charge down to 3s. 4d. To consumers having slot-meters an extra reduction of 1d. in the 1s. is made.

Water-Works Profits at Ipswich.—In submitting to the Town Council the accounts of their undertaking for the year to March 31, the Ipswich Water Committee reported that it was with much pleasure that they found themselves again able to transfer a considerable sum from the surplus profits to the credit of the general district fund. An amount equal to 1d. rate was transferred last year; and the Committee had intimated to the Finance Committee that a similar grant (£1260) would be made this year. When presenting the balance-sheet to the Council, however, Mr. R. G. Bennett remarked that he had been approached by several members of the Corporation with a view to a larger sum being handed over to the rates; and they had decided to offer another 1d. in the pound, making the contribution twice as much as had been originally agreed upon. He warned the Council that they must not expect such an amount towards the rates every year. In referring to the excellent results secured, he acknowledged the services rendered by Mr. C. W. S. Oldham as Manager of the undertaking. The quantity of water pumped from the wells in the twelve months was 587,349,000 gallons; being over 50,000,000 gallons more than in the preceding year. This, with 70,000,000 gallons derived from gravitation sources, makes a total supply of 657,349,000 gallons; the increase being largely accounted for by the abnormal summer weather, together with a bigger demand for water for trade purposes. The supply during the year was, however, fully maintained, and no restrictions were made, though continuous night and day pumping had to be resorted to for ten weeks in the summer.

West Bromwich Gas Undertaking.—The West Bromwich Gas Committee have issued a statement showing that the sales of gas during the financial year ended March 31 were 341,920,374 cubic feet, an increase of 10,070,155 feet over the previous year; and the amount of gas-rental was £41,181, an increase of £1162.

Darwen Gas and Water Results.—It was stated last Friday at a meeting of the Chairmen and Vice-Chairmen of the different Committees of the Darwen Corporation, held to consider the levying of rates for the current year, that there was a profit of £1073 on the water-works, and a loss on the gas undertaking of £150—due to the cotton lock-out and the recent coal strike.

Mansfield Gas-Works Profits.—In a report submitted by the Gas Committee to the Mansfield Town Council, it was stated that they anticipated being able to make a contribution of £1500 from the profits of the undertaking towards the general district rate. Alderman J. L. Wilson, in submitting the report, remarked that it was gratifying to be in a position to intimate that they had got through the recent coal crisis without inconvenience.

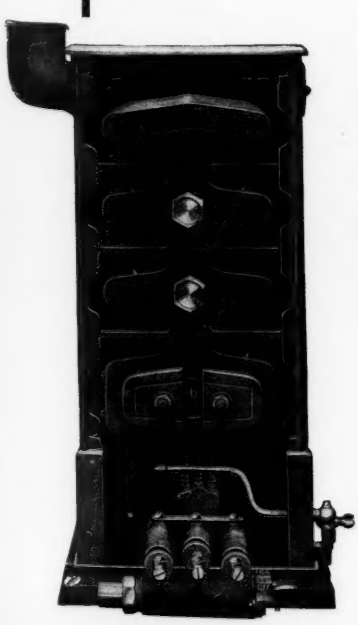
Increasing Gas Consumption at Chorley.—At the monthly meeting of the Chorley Town Council, the annual report of the Gas Manager (Mr. J. W. Allin) was submitted and approved. It showed that there had been an increase in the consumption of gas upon the previous year of over 13,000,000 cubic feet, and that since 1903 their increase had been 55,000,000 feet. If the present rate of increase was maintained it would be necessary in the near future, it was stated, to consider the question of extending the producing and purifying plant.

Coke Supply to the Poor during the Coal Strike.—In addition to reserving a supply of coke for bakers' use during the coal miners' strike, and making a substantial contribution to the public relief fund, the Newport (Mon.) Gas Company, in view of the prevailing distress, arranged to dispense a limited quantity of coke to poor families, in ½ cwt. lots, at a reduction of 1½d. per lot off yard prices. That this consideration was appreciated is evident from the fact that there have been as many as from 1100 to 1200 persons served in one day; the average cost to the Company being something like £4 per day. In view of the easier coal position, however, the special concession has ceased.

The Manchester City Council will have under consideration at tomorrow's meeting the Gas Committee's application for sanction to borrow £200,000 for purposes of development, chiefly in the meter, stove, and gas-fire departments.

A useful little scribbling pad is to hand from Messrs. A. H. Hamilton and Co. (paint, &c., manufacturers), of Possilpark, Glasgow, together with some particulars of a new preparation called "Gastite," which is intended to supersede white lead for gas-joints, and to prevent all waste. The preparation is made up in tubes, of which several sizes are stocked; and quantities are removed as required by pressing the lead tube between the fingers. What remains over from a job can in this way, of course, be kept soft and good.

Its Magnificent Simplicity.



The CALEFACTOR

has Boiler and Pre-heater cast in one piece.

Its internal passages run all one way.

Nothing winding, narrow, or inaccessible.

Everything open to the hand and eye, by undoing four milled-head screws.

What other is like it?

JOHN WRIGHT & CO.,
Essex Works,
BIRMINGHAM.

Test the Calefactor.

33.

The amount to be contributed by the Gas Department of the Oldham Corporation in relief of rates this year is £7500—the same as last year.

As a fact that may be useful in assisting to dispel prejudice, it is worthy of note that, in a shrubbery on the works of the Waltham Abbey and Cheshunt Gas and Coke Company, which contains various kinds of trees, &c., there has been discovered this year a Canadian maple in bloom. This being considered very exceptional, Mr. W. B. Randall, the Secretary and Engineer of the Company, sent some specimen flowers to Messrs. Fraser, of the South Woodford Nurseries, who replied that they did not remember having seen blooms of the kind before. They stated that the prolonged hot summer weather of 1911 was probably responsible for the tree flowering this season. It may be added that the tree referred to grows within a few yards of one of the gasholders.

A highly successful function was the fourth annual Gaslight and Coke Company show-room attendants' dinner and concert, which took place last Saturday, at the Florence Restaurant, Rupert Street, W. The dinner was good, the speeches were all to the point, and the musical programme was a most enjoyable one. Nothing, indeed, was left undone by the Hon. Secretary (Mr. H. E. Wright) and the Stewards (Messrs. F. Winmill and E. W. Hannington) to ensure a thoroughly pleasant evening. The party who sat down numbered about eighty-five, and included a large number of guests. The gathering had an excellent Chairman in Mr. J. E. Henwood, who, after the Loyal Toast had been honoured, proposed "The Gaslight and Coke Company," which was responded to by Mr. T. V. Fenn. The next toast, that of "The Show-Rooms," was submitted by Mr. E. W. Browning, and replied to by Mr. Wright and Mr. Gibbons. "The Chairman" was proposed by Mr. E. C. Holt. The remaining toasts were "The Visitors," which was submitted by Mr. F. Winmill, and acknowledged by Messrs. Ford, Webber, Roberts, and Holt, and "The Stewards," which was proposed by Mr. P. Davis.

APPLICATIONS FOR LETTERS PATENT.

8863.—Stokes, F. W. S., "Compressing air or gas." April 15.
8919.—Wadman-Smith, C. J. P., "Mode of increasing make of gas per ton of coal." April 16.
8976.—Stimson, E. F., "Gas-ovens." April 16.
9055.—Hazelwood, L. F., "Revolving-hook for gas-cookers." April 17.
9093.—Kent, W. G., "Recording-apparatus." April 17.
9095.—Strachan, R. P., and Strachan and Henshaw, Limited, "Telpher machines and tracks." April 17.
9186.—Burrell, P. J., "Controlling gas supply." April 18.
9197.—Kent, W. G., "Liquid meters." April 18.
9223.—Wilson, H. F., "Gas-stoves." April 19.
9239.—Evered, S., and Boxall, J. E., "Incandescent burners." April 19.
9244.—Farndale, G., "Gas-fittings." April 19.
9266.—Jones, T. M., "Regulating device for gaseous and other fluids." April 19.
9269.—Berlin-Anhaltische Maschinenbau-Akt.-Ges., "Quenching coke." April 19.
9276.—Löhle, K., "Gasholder-guides." April 19.
9292.—Glasgow, A. G., "Distillation of bituminous coal and the like." A communication from J. M. Rusby. April 19.
9293.—Glasgow, A. G., "Manufacture of carburetted water gas." A communication from J. M. Rusby. April 19.
9359.—Eagles, J., and Lodge, G. A., "Gas-testing chamber." April 20.
9406.—Beimann, W., "Quenching, screening, and loading coke." April 20.
9428.—Sugg, D. W., "Pressure-gauges for testing high-pressure gas-mains." April 20.
9431.—Kitson, A., "Incandescent light." April 20.

GAS COMPANIES' STOCK AND SHARE LIST.

The prevailing tendency on the Stock Exchange last week was a determination to take a bright view of things in general, though this laudable disposition had to encounter at times some influences which were scarcely conducive to its maintenance. There is a persistent feeling that better times are not far distant; and the public are quite ready with their money to come in and have a share in them. Business last week was to some extent affected by the fortnightly account, which was an unusually heavy affair, and not altogether devoid of anxiety. A disagreeable incident of the week was the failure of the Indian loan to win more than the feeblest support. The opening day was quiet, and the tone not over bright. Government issues were inactive, and Consols did not move. Rails languished and then improved; most issues advancing moderately. Americans were quite weak. Tuesday was brisker and brighter, with considerable enterprise in dealings in various quarters. Rails were strong, and some lines advanced nicely; but gilt-edged were rather flat. On Wednesday, things kept pretty active, and the tone was fair. Government issues were irregular; but Consols did not change. Rails continued to be quite cheerful; and Americans were better. Business was slacker on Thursday, and the tendency not clearly pronounced; but Consols jumped up ¼. Rails held on for awhile, and then gave way to realizations. Americans were dull and down. Friday was less active; being much occupied with the heavy settlement. Government issues were uneven; and Rails closed with as many changes one way as the other. Saturday was quite quiet, and the tendency was dullish. Consols closed at 78⅛-78⅜—a gain of ⅛ in the week. Rails gave way a little. The Money Market was quiet until a large demand for the Stock Exchange aroused it; and discount rates were rather firmer. Business in the Gas Market showed a falling off in point of activity—last week being one of those slack periods which occur now and then, as if in order to give the market breathing time between weeks of higher pressure. There were not many variations in price, and those were irregular. In Gaslight and Coke issues, the ordinary was moderately dealt in at the same figures as the week before—103 to 103¾—but just at the close a parcel went at 102¾, and the quotation was lowered ¼. In the secured issues, the maximum was done at 86, the preference at 103⅛ to 103¾, and the debenture at 79. South Metropolitan was quiet, and prices advanced from 117½ to 119½—a rise of ½ in the quotation. In Commercials, there was one bargain in the 3½ per cent. at 105. Among the Suburban and Provincial group, Alliance and Dublin realized 79½, Bournemouth preference 14⅝, South Suburban 123 and 123½, and Tottenham "B" 114½ special. On the local Exchange, Newcastle changed hands at 100 and 100¼. In the Continental companies, Imperial marked 192, Union 84, European 20 and 19¾ (a fall of ½), and Malta 4 13/16. Among the undertakings of the remoter world, Buenos Ayres debenture made 95½, Monte Video 12, Primitiva 7¾ and 7⅝, and ditto preference 5 5/16 and 5 3½.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	77—80	..	6 5 0
374,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Apl. 12	7½	Bombay, Ltd.	6—6½	..	5 15 5
50,000	10	Feb. 29	15	Bourne- mouth Gas and Water Pref. 6 p.c.	23⅜—25½	..	5 1 8
					16—16½	..	4 4 10
332,000	10	"	7		14—14½	..	4 2 9
75,000	10	"	6				
380,000	Stk.	"	13	Brentford Consolidated	258—263	..	4 18 10
330,000	"	"	10	Do. New	195—200	..	5 0 0
50,300	"	"	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	"	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	"	"	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Mar. 28	12½	British	45—46	..	5 8 8
120,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
109,000	"	Feb. 15	6	Bromley, A 5 p.c.	128—133	..	4 10 3
165,700	"	"	4½	Do. B 3½ p.c.	98—101	..	4 9 1
82,278	"	"	5½	Do. C 5 p.c.	117—120	..	4 11 8
55,000	"	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	"	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
167,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	108—110	..	4 19 4
560,000	"	"	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	"	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	"	4	Continental Union, Ltd.	82—85	..	4 14 2
200,000	"	"	7	Do. 7 p.c. Pref.	136—138	..	5 1 5
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	"	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	19½—20½	−½	4 17 7
16,160,600	Stk.	Feb. 15	4/14/8	Gas-light and Coke Ord.	102⅝—103⅝	−¼	4 11 3
2,600,000	"	"	3½		84—86	..	4 1 5
4,062,235	"	"	4	and Coke 4 p.c. Con. Pref.	102—104	..	3 16 11
4,531,705	"	Dec. 14	3	3 p.c. Con. Deb.	78—80	..	3 15 0
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3½ p.c.	93—95	..	5 5 3
82,500	"	"	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	16½—17*	..	6 9 5
131,000	Stk.	Mar. 14	7½	Ilford A and C	152—154	..	4 17 5
65,780	"	"	6	Do. B	123—125	..	4 16 0
65,500	"	Dec. 29	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
4,940,000	Stk.	Nov. 10	9	Imperial Continental	190—193	..	4 13 3
1,335,000	Stk.	Feb. 15	3½	Do. 3½ p.c. Deb. Red.	88—90	..	3 17 9
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	219—221	−1	4 10 6
718,100	"	"	7	Do. B.	159—161	−½	4 6 11
806,083	"	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4⅜—5	..	6 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	"	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 10	3½	Monte Video, Ltd.	12—12½	..	5 12 0
1,775,892	Stk.	Feb. 15	4½	Newc'tle&G'tesh'd Con.	99—101	..	4 6 8
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	86—88	..	3 19 7
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	Dec. 14	8	Oriental, Ltd.	137—139	..	5 15 1
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7½	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	137—140	..	4 18 4
60,000	50	"	13	Do. B	130—133	..	4 17 9
100,000	50	"	12	Do. C	127—130	..	4 12 4
398,490	5	Oct. 12	8	Primitiva Ord.	7⅞—7¾	..	5 2 5
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5¼—5⅜	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
250,000	5	Apl. 12	12	San Paulo, Ltd.	11¼—11⅝	..	5 2 2
115,000	10	"	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	235—237	..	4 4 5
209,984	"	"	10	Do. B	234—236	..	4 4 9
523,500	"	"	10	Do. C	234—235	..	4 5 1
90,000	10	Sept. 28	6	South African	8—9	..	6 13 4
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	117½—119½	+½	4 11 4
1,895,445	"	Jan. 12	3	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,820	Stk.	Feb. 29	8½	South Shields Con. Stk.	156—158	..	5 7 7
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	122—124	..	4 14 0
60,000	"	"	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	"	Jan. 12	5	Do. 5 p.c. Deb. Stk.	119—121	..	4 2 8
502,310	Stk.	Nov. 10	5	Southampton Ord.	107—109	..	4 11 9
120,000	Stk.	Feb. 15	7⅝	Tottenham and A 5 p.c.	144—147	..	4 17 0
483,940	"	"	5⅝	B 3½ p.c.	114—116	..	4 17 0
149,470	"	Dec. 29	4	Edmonton 4 p.c. Deb.	96—98	+1	4 1 8
182,380	10	"	5	Tuscan, Ltd.	8⅜—8⅞	..	5 12 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	"	6⅞	Wands- B 3½ p.c.	141—144	..	4 15 6
85,766	"	Dec. 29	3	worth 3 p.c. Deb. Stk.	71½—73½	..	4 1 8

Prices marked * are "Ex. div."